

Get Set Go for
NEET | JEE
CLASS XI CLASS XII

www.mtg.in | December 2021 | Pages 92 | ₹ 40

Class XI & XII **CBSE** warm up! **TERM-I**

CHEMISTRY

India's #1
CHEMISTRY MONTHLY FOR
JEE (Main & Advanced) & NEET

t  day

**CONCEPT
MAP**

**LEARN
FAST**

BRUSH UP *for*
NEET/JEE

Class
XI & XII

mtg

Trust of more than
1 Crore Readers
Since 1982



2021120013174

**MONTHLY
TEST DRIVE**

CLASS XI & XII

ALLEN[®] CAREER INSTITUTE

JEE (ADV.) 2021



AIR-1
JEE (ADV.) | KVPY | JEE (MAIN) 2021
MRIDUL AGARWAL
Classroom Course

AIR 7  KARTIK SREEKUMAR Distance	AIR 9  ARNAV ADITYA SINGH Classroom	AIR 12  MANPREET SINGH Classroom
AIR 13  ANANTH K. KIDAMBI Classroom	AIR 14  AMEYA P. DESHMUKH Classroom	AIR 15  TANAY VINIT TAYAL Classroom

49

**STUDENTS
IN TOP 100
ALL INDIA RANKS**

Total Students Qualified

5502

CCP : 3260 | DLP : 2242

40

**STUDENTS
IN TOP 100
ALL INDIA RANKS**

Total Students Qualified

76789

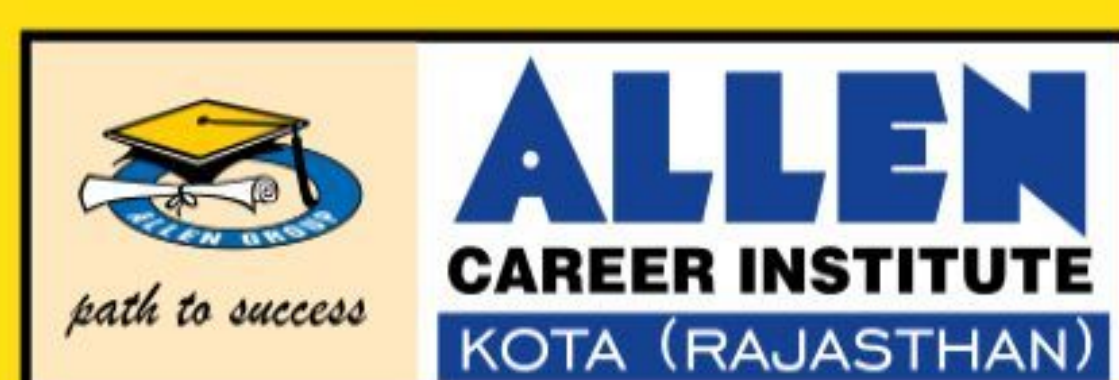
CCP : 38816 | DLP : 37973

NEET (UG) 2021

AIR 1  720 / 720 MRINAL KUTTERI Distance	AIR 4  716 / 720 AMAN TRIPATHI Classroom	
AIR 5  715 / 720 HRUTUL CHHAG Classroom	AIR 5  715 / 720 SUYASH ARORA Classroom	AIR 5  715 / 720 HRIDAY V. MOHITE Distance

JEE (Main+Adv.) | JEE (Main) | NEET (UG) | NTSE | OLYMPIADS | PNCf | Class 6th to 12th & 12th Pass / Repeaters
Global Studies | Early Childhood Development (Class HKG to 8th)

For Admission Details log on to www.allen.ac.in or Call 0744-2757575



Corporate Office:

"SANKALP", CP-6, Indra Vihar, Kota (Raj.)

Whatsapp: 0744-2757700 | Web: www.allen.ac.in

National Helpline

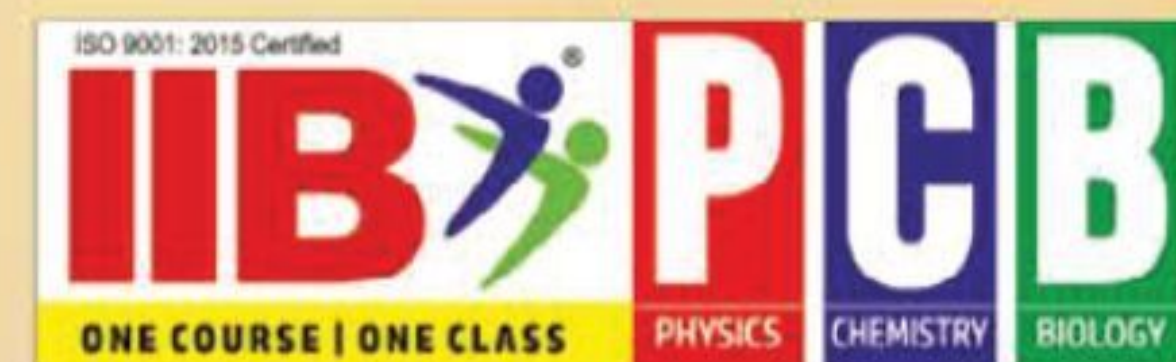
0744-2757575

0744-3556677

Disclaimer : The content available in MTG digital/physical books is intellectual property of MTG Learning Media Pvt Ltd. Paid content on this website after purchase is not entitled for free distribution on whatsapp, telegram, twitter, facebook, and all other social media and digital channels. The registered owner/admin/ individual of any digital channel will be liable for an infringement of the copyright for illegally using the material / copyrighted content of MTG Learning Media Pvt Ltd.

A class of Trustability for Students and Parents

THINK NEET THINK IIB



In The History of NEET 2021 IIB's
**RECORD BREAKING
UNBEATABLE EXECUTION
IN INDIA**

For the
First time in the
history of NEET
IIB's Commendable
contribution

33 Students have scored in **Biology** **360** Out of **360**



146 Students
Scored
600 Plus Marks
In PCB

611 Students
Scored
500 Plus Marks
In PCB

**IIB IS NOW
SETTING NEW
BENCHMARKS
IN PCB**

132 Students
Scored
355 Plus Marks
In Biology

250 Students
Scored
350 Plus Marks
In Biology

1208 Students
Scored
300 Plus Marks
In Biology



NANDED LATUR
7304730730 | 7304567567

www.iibedu.com | info@iibedu.com



Above result is an outcome of Offline or Online classroom program, Test series, Crash Course and PCB Adhar program.

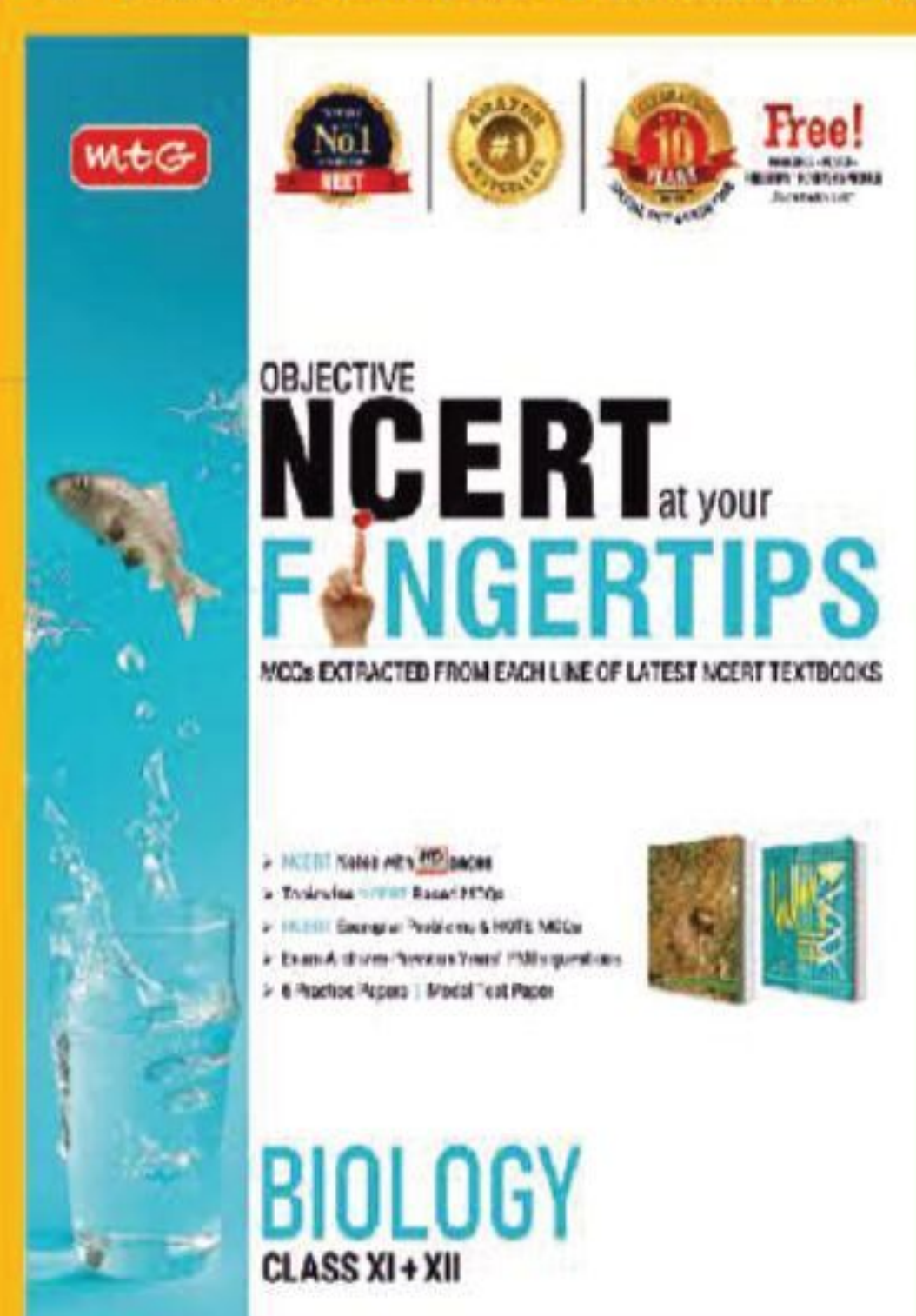
mtG

Success Made Simple

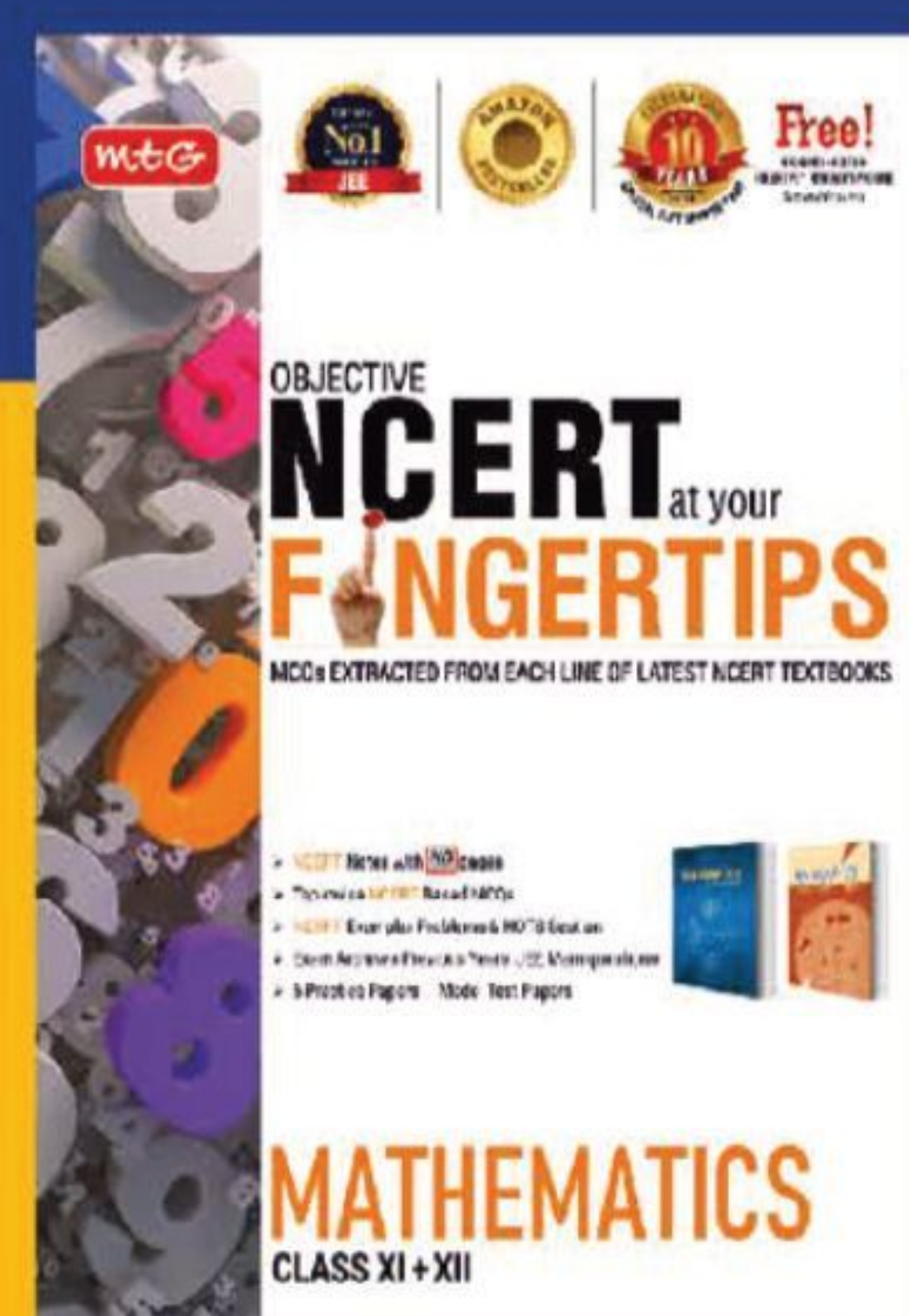
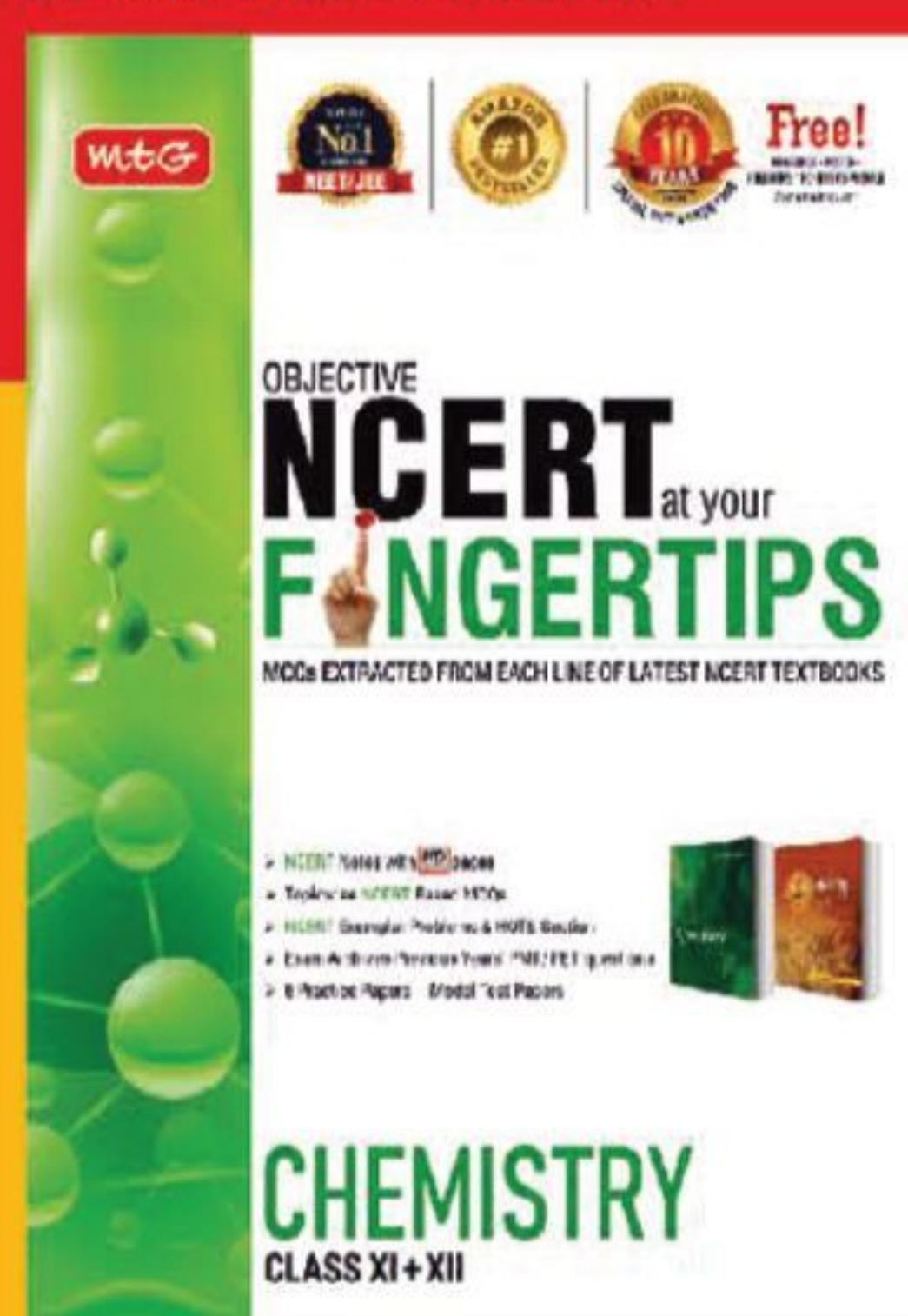
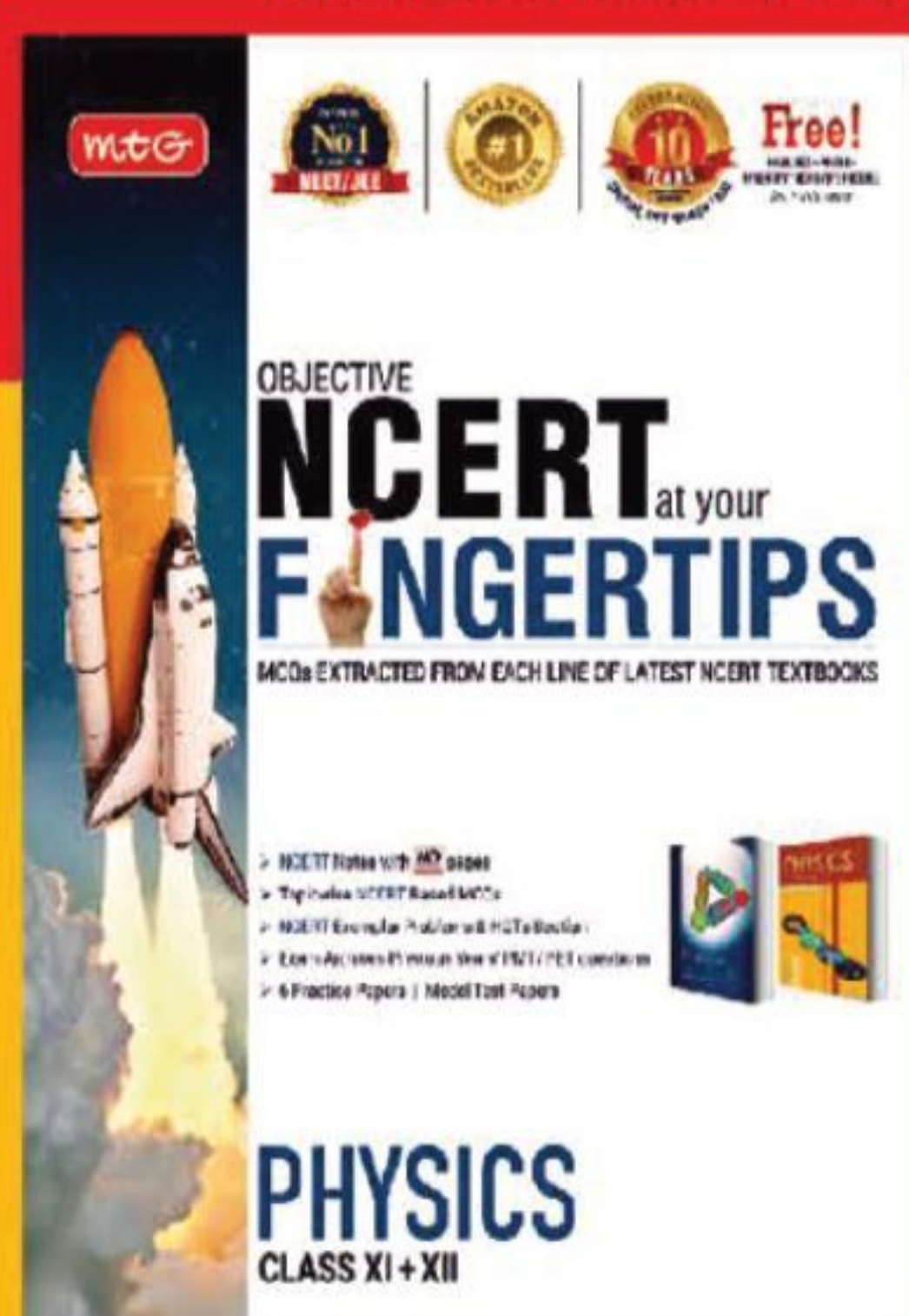
IF YOU AIM TO BE #1, BE WITH THE #1.

(IT'S THAT SIMPLE!)

#1 BESTSELLER ON AMAZON



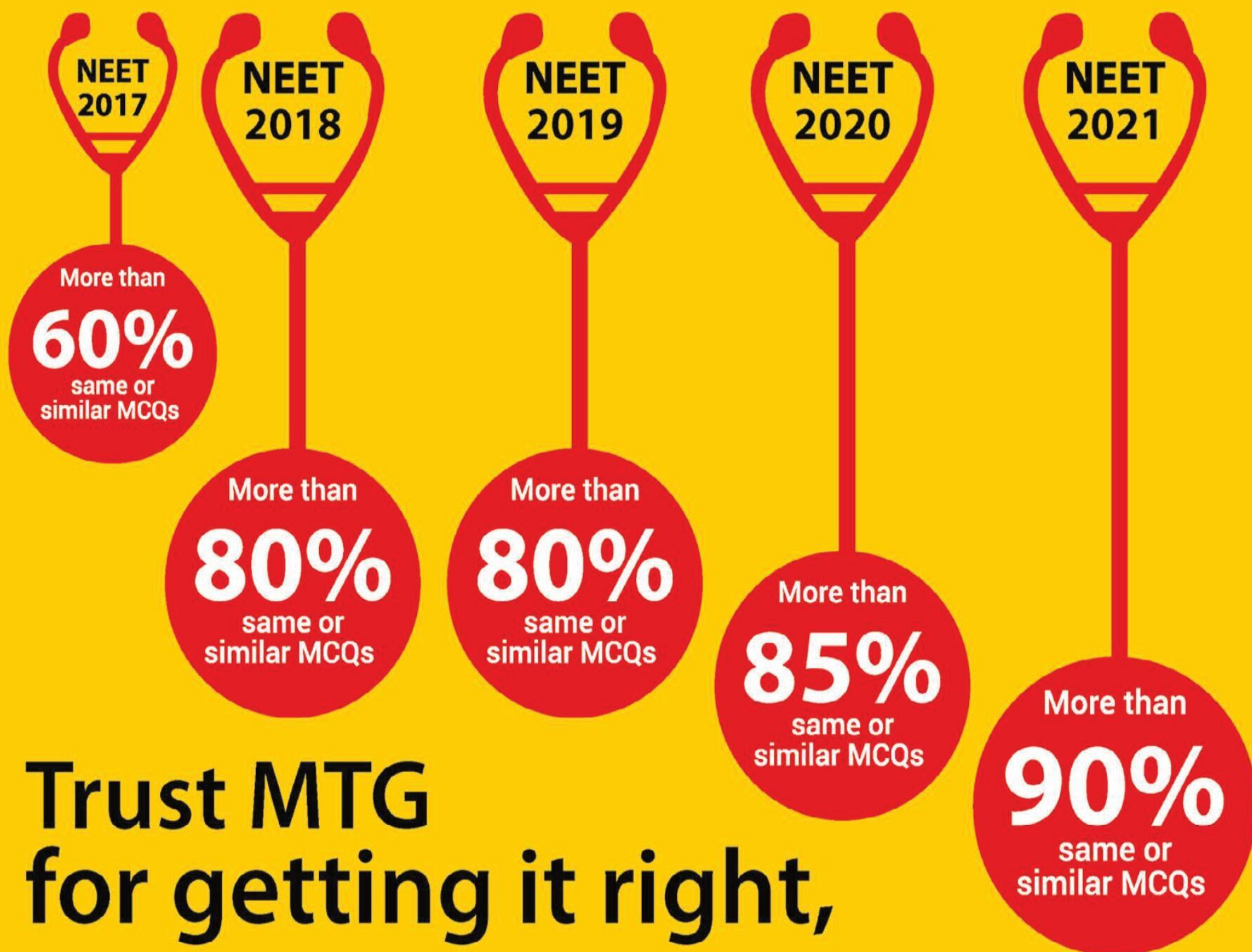
AMONG TOP 10 AMAZON BESTSELLERS



WHAT MAKES US #1:

- Chapterwise NCERT Notes for quick-and-easy revision
- Topicwise MCQs to check your progress
- NCERT Exemplar MCQs
- Assertion & Reason questions for an edge in your competitive exams Preparation
- HOTS MCQs to boost your concepts
- 6 Practice Papers for self-assessment
- High Definition (HD) multicolour pages

Call 0124-6601200/1800-10-38 673 or email info@mtg.in to learn more



Trust MTG for getting it right, year after year

Over the last 5 years, MTG has averaged a hit rate of 79% when it comes to curating the right content for your NEET preparation. Which means approx. 3 out of 4 questions in NEET were either exactly the same as, or similar to, questions in MTG's NEET books. The credit for this mind-blowing feat goes to MTG's skilled and experienced editorial team which painstakingly goes through volumes of NCERT subject matter that forms the basis for NEET, to create superior and relevant study material that has a high chance of success for its users. Proof lies in the pudding, right!

#1 Bestseller on Amazon



Scan to buy on mtg.in

To find out which MTG NEET book is best-suited to your needs,
Call our NEET helpline **0124-6601200** today.
Or email info@mtg.in now. Visit bit.ly/mtg-neet to buy online.

mtg



Scan to buy on Amazon.in

CLASS
12
LATEST PATTERN
AND REVISED
SYLLABUS

CBSE 2021-22
TERM-I



**Based on Latest
Competency Based
Education (CBE)**

Price
₹ 175/-
each

CBSE 2021-22
TERM-I

CLASS **12**
BASED ON
LATEST PATTERN

mtg
ScoreMore
10 SAMPLE PAPERS

PHYSICS

- ✓ Sample Question Papers (SQPs) with BLUEPRINT as design issued by CBSE
- ✓ Latest CBSE Term-I (2021-22) Sample Question Paper
- ✓ OMR Sheet provided after each SQP

Based on Latest Competency Based Education (CBE)

STRICTLY BASED ON THE DESIGN OF SAMPLE QUESTION PAPER ISSUED BY CBSE IN SEPTEMBER 2021

CBSE 2021-22
TERM-I

CLASS **12**
BASED ON
LATEST PATTERN

mtg
ScoreMore
10 SAMPLE PAPERS

CHEMISTRY

- ✓ Sample Question Papers (SQPs) with BLUEPRINT as design issued by CBSE
- ✓ Latest CBSE Term-I (2021-22) Sample Question Paper
- ✓ OMR Sheet provided after each SQP

Based on Latest Competency Based Education (CBE)

STRICTLY BASED ON THE DESIGN OF SAMPLE QUESTION PAPER ISSUED BY CBSE IN SEPTEMBER 2021

CBSE 2021-22
TERM-I

CLASS **12**
BASED ON
LATEST PATTERN

mtg
ScoreMore
10 SAMPLE PAPERS

MATHEMATICS

- ✓ Sample Question Papers (SQPs) with BLUEPRINT as design issued by CBSE
- ✓ Latest CBSE Term-I (2021-22) Sample Question Paper
- ✓ OMR Sheet provided after each SQP

Based on Latest Competency Based Education (CBE)

STRICTLY BASED ON THE DESIGN OF SAMPLE QUESTION PAPER ISSUED BY CBSE IN SEPTEMBER 2021

CBSE 2021-22
TERM-I

CLASS **12**
BASED ON
LATEST PATTERN

mtg
ScoreMore
10 SAMPLE PAPERS

BIOLOGY

- ✓ Sample Question Papers (SQPs) with BLUEPRINT as design issued by CBSE
- ✓ Latest CBSE Term-I (2021-22) Sample Question Paper
- ✓ OMR Sheet provided after each SQP

Based on Latest Competency Based Education (CBE)

STRICTLY BASED ON THE DESIGN OF SAMPLE QUESTION PAPER ISSUED BY CBSE IN SEPTEMBER 2021

CBSE 2021-22
TERM-I

CLASS **12**
BASED ON
LATEST PATTERN

mtg
ScoreMore
10 SAMPLE PAPERS

ENGLISH CORE

- ✓ Sample Question Papers (SQPs) with BLUEPRINT as design issued by CBSE
- ✓ Latest CBSE Term-I (2021-22) Sample Question Paper
- ✓ OMR Sheet provided after each SQP

Based on Latest Competency Based Education (CBE)

STRICTLY BASED ON THE DESIGN OF SAMPLE QUESTION PAPER ISSUED BY CBSE IN SEPTEMBER 2021

Available at all leading book shops throughout India.
For more information or for help in placing your order,
Call 0124-6601200 or e-mail: info@mtg.in

Strictly Based on the design of Sample Question Paper
issued by CBSE in September 2021

Tips to make the most of your drop year

Taking a break of a year to study for JEE or NEET is an option steeped in positives. You just need to know what they are. Read on...

Let's address the elephant in the room: Preparing for JEE or NEET exam is a mammoth task. Taking a year off to prepare for it, is equally huge. Take heart though, many students may take a year off to study for two of the most prestigious examinations in the country, which can get them entrance into premier engineering or medical colleges in India. These two entrance exams are typically taken by students while they are in Class 12 or after they clear it. Considering the extensive syllabus, there's a chance that some of you might require a couple of attempts. Whatever be the case, if you do decide to drop a year after your 12th board exam, there are several things you need to take into consideration.

Let's face it

The drop year is going to be frantic. In one year, you will be required to revisit and revise the entire syllabus of Class 11 and Class 12. The good part about this is that you are done with your board exams, and school. Now, you can completely focus on JEE or NEET. But first, pause a bit, and self-evaluate: Assess the problems associated with your exam preparation of previous year/years.

- * Was it the lack of consistency, knowledge or time?
- * Or was it something else?

You can overcome your initial mistakes with proper planning and time management in the drop year. Here are a few tips that can help you make the best of your drop year.

Analyse your strengths and weaknesses

In the scenario that you have already attempted the exam once before, analyse how you performed in it and what is your current preparation level. Go back to the question paper, and go through it carefully. If you solved a question correctly, was your solution the best one? Was there a more appropriate solution to the question? Could you have solved it faster? If you did not answer a question correctly, find out why. Did you not have enough knowledge of the topic? Did you make a silly mistake? Use this detailed analysis to divide all topics of the syllabus into three segments: Strong, Mediocre and Weak. Doing this is crucial as this will set the tone of your entire preparation effort.

Gather your resources

Next, figure out what resources you need to prepare again:

- **Coaching :** One of the most important decisions for you is whether or not to opt for coaching. That depends on how well you prepared in the previous years and how much guidance you need this year. If you decide to go for expert guidance, there are several options. You can choose the traditional physical coaching or you can opt for a live online course. The advantage of online courses offered by apps such as Amazon Academy is that you learn from expert faculty in the country from the comfort of your home. You don't have to travel daily. That saves time. You also get detailed performance analytics and a wide array of mock tests and practice material alongside the course. While there are several free videos available online, it's better if you have a structured course to help streamline your preparation. Of course, you can use free online videos to know more about a particular topic but to rely on them completely may not be a good move.
- **Books :** A myth-buster for you all — more books do not mean better preparation. Like the saying, 'Too many cooks spoil the broth', having too many books might distract you from focusing on any! If you have prepared for JEE or NEET in Class 11/ 12, you would have a fair idea of the books available for various subjects. Here's a tip: NCERT books are a must, both for JEE and NEET. Apart from that, you could consider investing only in a couple of other books that have relevant material. Ask your teachers to recommend books. Make sure to have a mix of theory and practice books. Don't burden yourself with advanced books unless you feel confident about your preparation and you can go the extra mile.
- **Practice Material :** At the very least, you should consider joining an All India Mock Test (AIMT) series. Most coaching setups, whether online or offline, provide an All India Test series along with their full courses. If not, buy one. Amazon Academy conducts live AIMTs at scheduled intervals designed to replicate the actual exam experience for its subscribers. This not only exposes you

to the nuances of the examination, but also prepares you mentally for D-day. Apart from this, you should have ample material for chapter-wise or topic-wise practice. You can choose to practice with books, coaching modules or independent practice material.

Make a plan

The next step is to formulate an efficient plan. You know the schedule of your lectures by now, if any. Do the following:

- **Make a timetable.** Take the number of hours available in the day and divide your time amongst study, practice, and revision. Set daily goals and ensure that you meet them.
- **Set specific timelines for individual topics and chapters.** You have a year. Plan accordingly. Make sure to allocate some time before the exam for dedicated revision.
- **Be smart about your time allocation.** Now is the time your 'Strong, Mediocre and Weak' areas come into play. When you are setting your timelines, make sure you allot more time to topics you are mediocre or weak in. Mediocre areas may turn into your strengths with relatively lesser effort.
- **Don't forget to schedule time for breaks, sleep, and fun.** While every minute you spend away from books might seem like a minute wasted, it's really not. Your concentration and retention improve considerably when your mind is well-rested. In reality, short breaks may extract more value out of your study hours.

Start from the top

For both JEE and NEET, the most fundamental requirement is that your concepts are clear. If you did not crack the exam in your first attempt, this year you have another chance to go back to the basics.

- **Do not take shortcuts.** Even if you think that you know a topic well, take the time to review it from scratch.
- **Strengthen your basics.** Many advanced topics in JEE and NEET derive from the basic concepts taught in Class 10 or 11. If you don't know them well, the chances of you excelling in the advanced topics are minimal.
- **Ask doubts.** Don't shy away from asking questions. That's what teachers are for. Ask until you have completely understood. Don't leave any room for doubts. Students opting for online apps such as Amazon Academy have various options and opportunities to get their concepts and doubts cleared by expert faculties.

Make Notes

According to the Ebbinghaus Forgetting Curve, you forget about 70 per cent of what you learn in the first 24 hours. This should underline the immense significance of revision in JEE and NEET preparation. One of the most effective ways of absorbing information is by writing it down, this way you are

more likely to remember what you studied. Hence, despite having access to all the study materials digitally, including short notes and formula sheets, you should still make your own notes. Colour-code the notes as per your preference. It is not a waste of time as some believe.

Practice

Here's a secret formula to success : Practice!... And you thought there was a shortcut to success! Well, there isn't. Only extensive practice will make you perfect. Your last two to four years of school preparation has already readied you for JEE/NEET exam. All you have to do now is practise old concepts and topics.

- **Employ different techniques for different subjects.** If you are preparing for NEET, Biology requires you to learn a lot of facts and diagrams, and you must improve your retention to perform well. However, a subject such as Physics requires you to work on your conceptual and calculation skills. Derivation is essential for Math. Rely on your teachers to guide you.
- **Take regular mock tests.** You have already covered the syllabus once in your last attempt. Regardless of whether or not you have finished your syllabus, attempt mock tests. This will help you improve your test-taking skills.
- **Take AIMTs.** All India Mock Tests are a must. They help you gauge your preparation as compared to the other candidates. They are timed and you should take them in a simulated exam environment.
- **Solve chapter-wise questions.** Apart from full length tests, you should also solve questions for individual topics as you learn them. This will help you in understanding and retaining the topic better for the exam.

Revise

This one is obvious. You must revise well. Learn from your mistakes in the previous attempt and make sure you don't repeat them in this one. Do remember that revision is not the time to learn new topics you may have missed. Only focus on revising material you have already learnt or practiced as the exam date draws near.

Stay Motivated

Dropping a year is challenging. Along with the strenuous academic demands, you are faced with tremendous mental and emotional pressures too. It is easy to feel exhausted or even burnt out. But, you must work on keeping yourself motivated. Keep your dream college in mind. Ask friends and family to nudge you, to build that focus. The 'light' at the end of the long, arduous study tunnel is just 10-12 months away. Chin up till then!

Disclaimer: The information provided in this article is of a general nature and should not be considered a substitute for professional advice.



CHEMISTRY today

Volume 30

No. 12

December 2021

Managing Editor
Mahabir Singh

Editor
Anil Ahlawat

Corporate Office:

Plot 99, Sector 44 Institutional area, Gurugram -122 003 (HR).

Tel : 0124-6601200 e-mail : info@mtg.in website : www.mtg.in

Regd. Office:

406, Taj Apartment, Near Safdarjung Hospital, New Delhi - 110029.

Class 11

Get Set Go for NEET 11

Brush Up for NEET / JEE 15

The p-Block Elements (Group 13 & 14)

CBSE Warm Up 27

Practice Paper 2021

Monthly Test Drive 38

Some Basic Concepts of Chemistry | Structure of Atom

Class 12

Get Set Go for JEE 42

Concept Map 46

Condensation Reactions

Brush Up for NEET / JEE 48

Haloalkanes and Haloarenes | Alcohols, Phenols and Ethers

CBSE Warm Up 65

Practice Paper 2021

Learn Fast 76

IUPAC Nomenclature of Organic Compounds

Monthly Test Drive 83

Metallurgy | The p-Block Elements (Group 15 to 18)

Subscribe online at www.mtg.in

Individual Subscription Rates	Combined Subscription Rates		
	9 months	15 months	27 months
Mathematics Today	300	500	850
Chemistry Today	300	500	850
Physics For You	300	500	850
Biology Today	300	500	850

Send D.D/M.O in favour of MTG Learning Media (P) Ltd.
Payments should be made directly to : MTG Learning Media (P) Ltd,
Plot No. 99, Sector 44, Gurugram - 122003 (Haryana)
We have not appointed any subscription agent.

Printed and Published by Mahabir Singh on behalf of MTG Learning Media Pvt. Ltd. Printed at HT Media Ltd., B-2, Sector-63, Noida, UP-201307 and published at 406, Taj Apartment, Ring Road, Near Safdarjung Hospital, New Delhi - 110029.

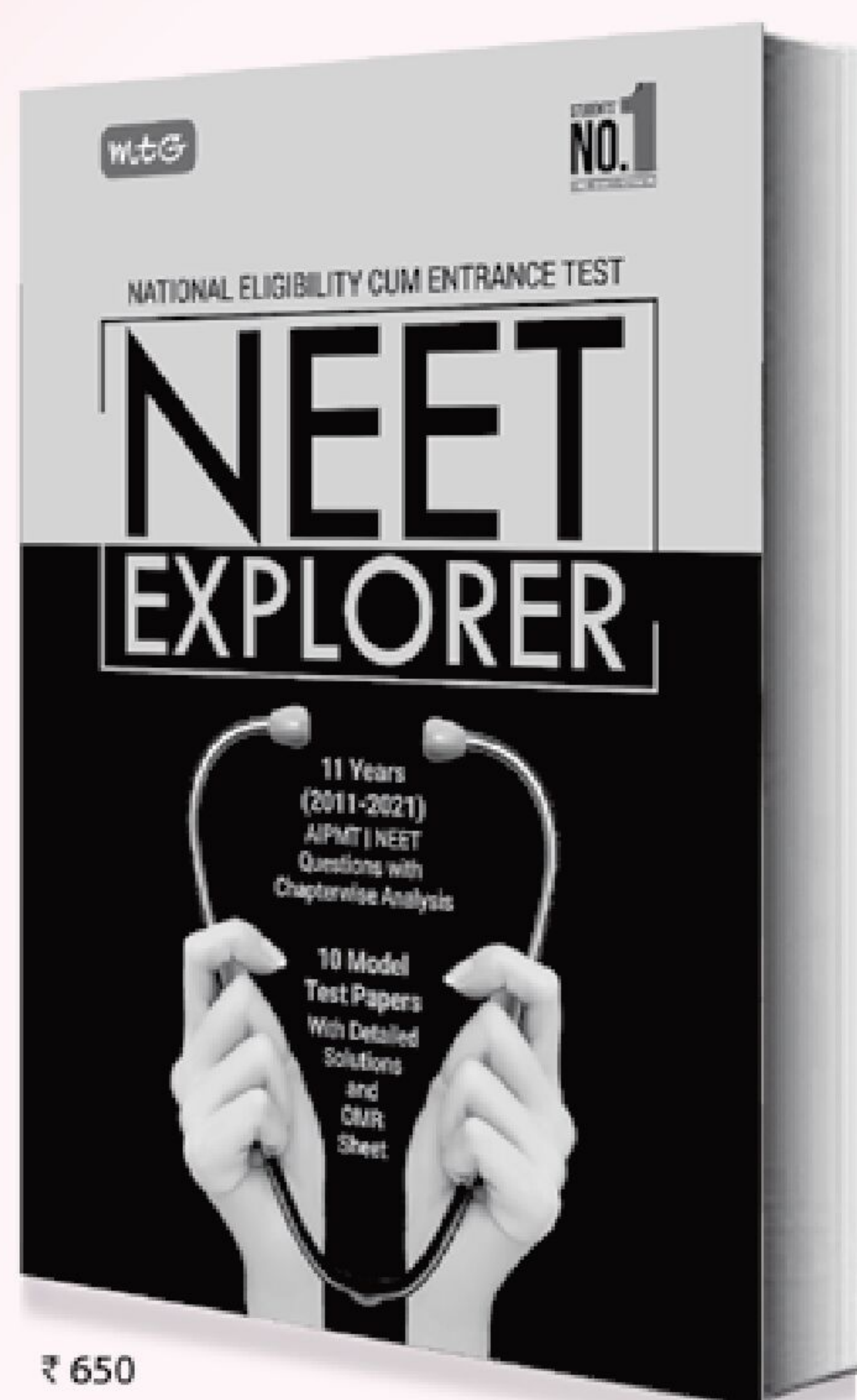
Editor : Anil Ahlawat

Readers are advised to make appropriate thorough enquiries before acting upon any advertisements published in this magazine. Focus/ Infocus features are marketing incentives. MTG does not vouch or subscribe to the claims and representations made by advertisers. All disputes are subject to Delhi jurisdiction only.

Copyright© MTG Learning Media (P) Ltd.

All rights reserved. Reproduction in any form is prohibited.

Last-minute check on your NEET readiness



₹ 650



MTG's NEET Explorer helps students self-assess their readiness for success in NEET. Attempting the tests put together by MTG's experienced team of editors and experts strictly on the NEET pattern and matching difficulty levels, students can easily measure their preparedness for success. Order now!



Scan now with your smartphone or tablet*

HIGHLIGHTS:

- 10 Model Test Papers based on latest NEET syllabus
- Last 11 years' solved test papers of AIPMT / NEET
- Includes NEET 2021 solved paper
- OMR Sheet provided after each Model Test Paper
- Detailed solutions for self-assessment and to practice time management



Available at all leading book shops throughout India.
For more information or for help in placing your order:
Call 0124-6601200 or email: info@mtg.in

*Application to read QR codes required

Visit
www.mtg.in
for latest offers
and to buy
online!

GET SET GO NEET



with exclusive and brain storming MCQs

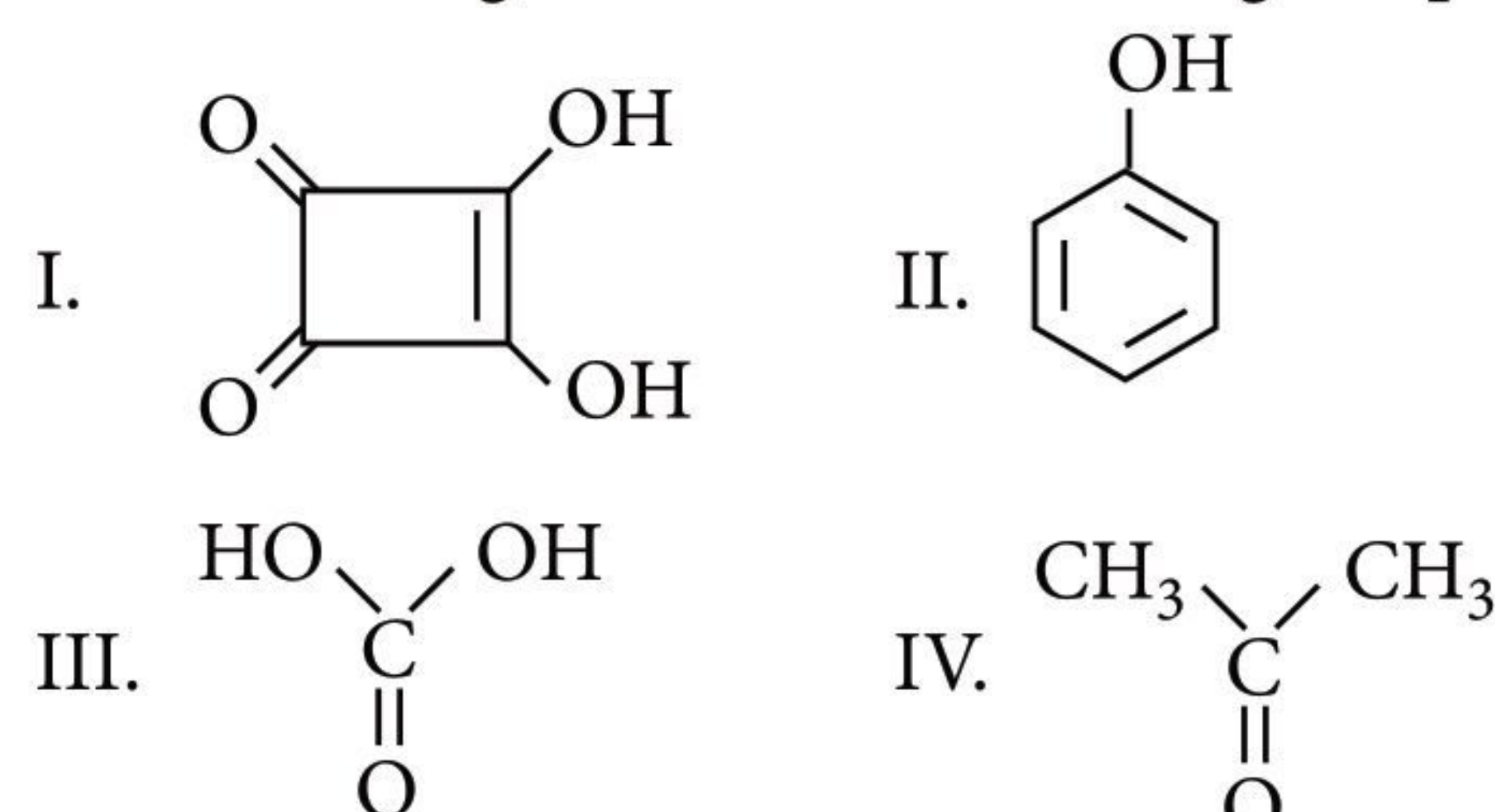
Practicing these MCQs help to strengthen your concepts and give you extra edge in your NEET preparation

1. Match the column-I with column-II and choose the correct option.

Column-I (element)		Column-II (group number)	
(A)	An element whose fourth shell contains two p -electrons	(p)	8 th group
(B)	An element whose valence shell contains one unpaired p -electron	(q)	12 th group
(C)	An element which receives last electron in $(n - 1)$ d -subshell	(r)	14 th group
(D)	An element with the ground state electronic configuration $[\text{Ar}]4s^23d^{10}$	(s)	17 th group
A	B	C	D
(a) p	q, r	s	q
(b) r	p, q	q	s
(c) r	s	p, q	q
(d) q	p	p, s	r

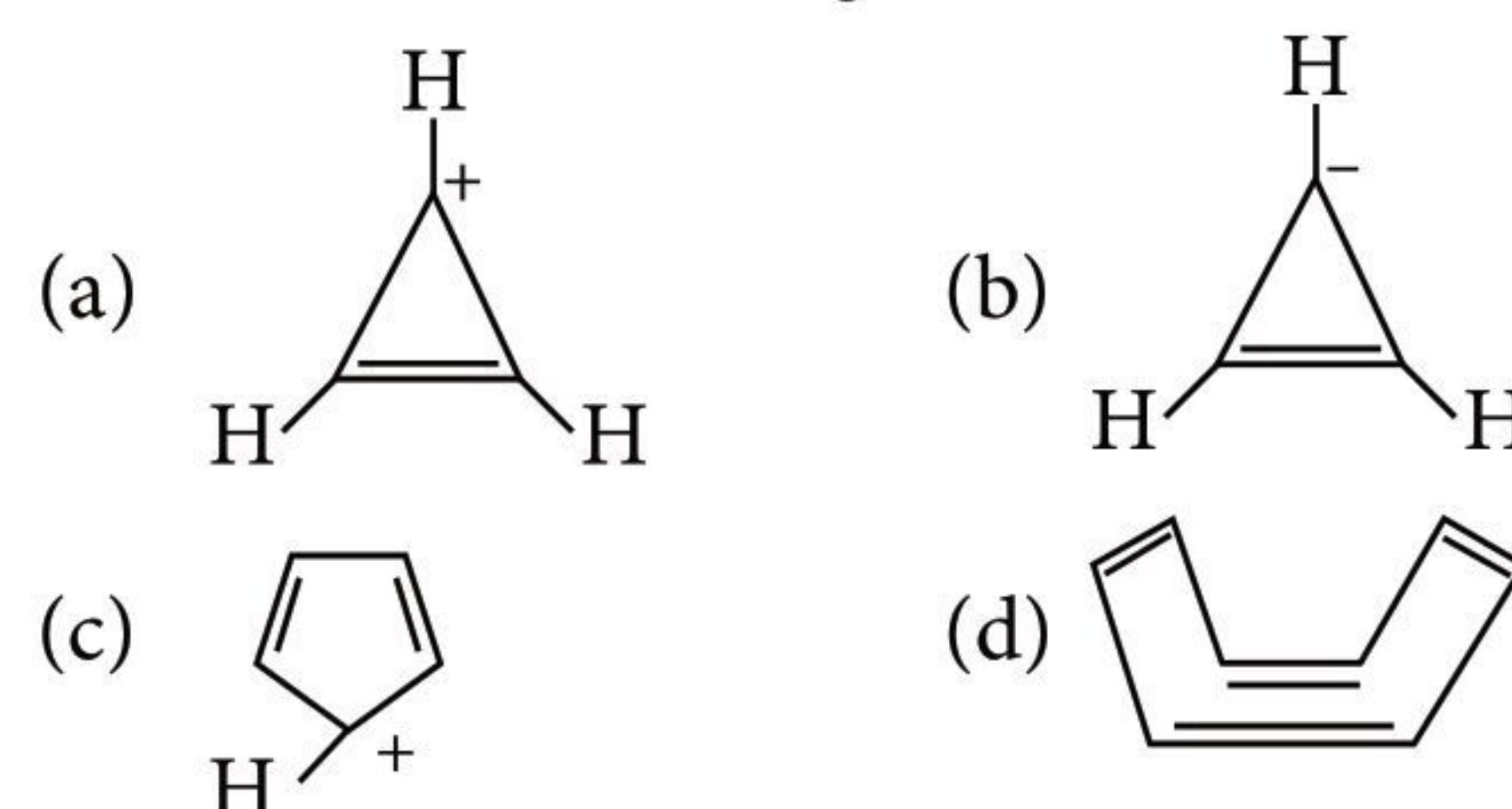
2. The correct order of the increasing s -character of the orbital of B which overlaps with the orbital of F to form B—F bond in BF_2^+ , BF_3 and BF_4^- is
- (a) $\text{BF}_2^+ < \text{BF}_4^- < \text{BF}_3$ (b) $\text{BF}_3 < \text{BF}_2^+ < \text{BF}_4^-$
 (c) $\text{BF}_2^+ < \text{BF}_3 < \text{BF}_4^-$ (d) $\text{BF}_4^- < \text{BF}_3 < \text{BF}_2^+$

3. The acid strength order of the following compounds is :



- (a) $\text{I} > \text{IV} > \text{II} > \text{III}$ (b) $\text{III} > \text{I} > \text{II} > \text{IV}$
 (c) $\text{II} > \text{III} > \text{I} > \text{IV}$ (d) $\text{I} > \text{III} > \text{II} > \text{IV}$

4. Which of the following is an aromatic compound?

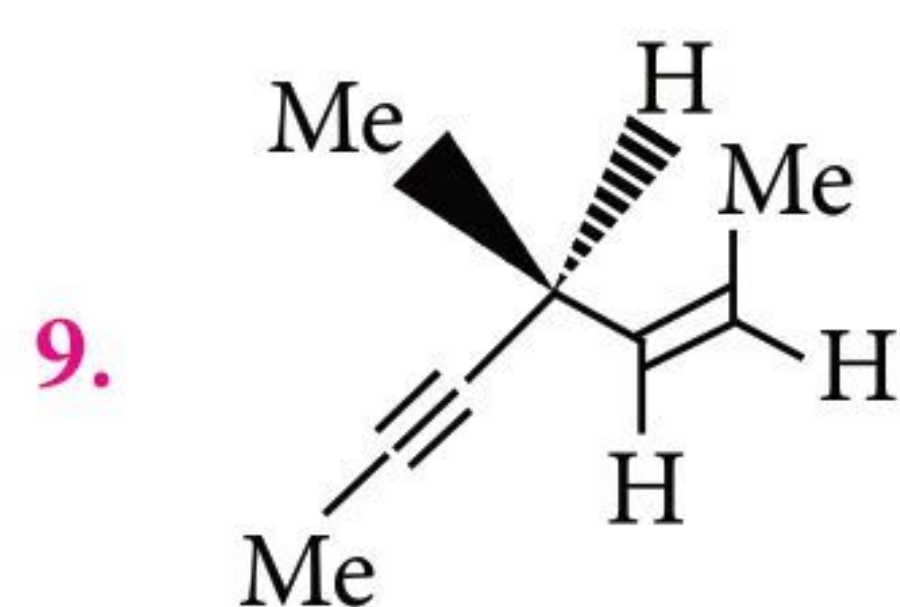


5. Which causes nerve signals in animals?
- (a) Electrical potential gradient due to transfer of K^+ ions.
 (b) Electrical potential gradient due to transfer of Na^+ ions in $(\text{Na}^+ - \text{Ca}^{2+})$ pump.

- (c) Electrical potential gradient set up due to transfer of Ca^{2+} ions.
 (d) No nerve signal exists in animals.
6. A metal (M) burns with dazzling brilliance in air to give a white powder. The product reacts with water to form a white precipitate and a colourless gas with a characteristic smell. The metal (M) decomposes hot water but not cold water, liberating the inflammable hydrogen gas. The metal (M) is
 (a) K (b) Ca (c) Mg (d) Rb

7. 10 mL of 0.1 M tribasic acid H_3A is titrated with 0.1 M NaOH solution. What is the ratio of $\frac{[\text{H}_3\text{A}]}{[\text{A}^{3-}]}$ at 2nd equivalence point? (Given: $K_1 = 7.5 \times 10^{-4}$, $K_2 = 10^{-8}$ and $K_3 = 10^{-12}$)
 (a) $\sim 10^{-4}$ (b) $\sim 10^4$
 (c) $\sim 10^{-7}$ (d) $\sim 10^6$

8. Which of the following statements is correct about the given redox reaction?
 $\text{MnO}_4^- + \text{S}_2\text{O}_3^{2-} + \text{H}^+ \longrightarrow \text{Mn}^{2+} + \text{S}_4\text{O}_6^{2-}$
 (a) 1 mole of $\text{S}_2\text{O}_3^{2-}$ is oxidised by 8 moles of MnO_4^- .
 (b) The above redox reaction with the change of pH from 4 to 10 will have an effect on the stoichiometry of the reaction.
 (c) Change of pH from 4 to 7 will not change the nature of the product.
 (d) At pH = 9, $\text{S}_2\text{O}_3^{2-}$ ions are oxidised to HSO_4^- ions.



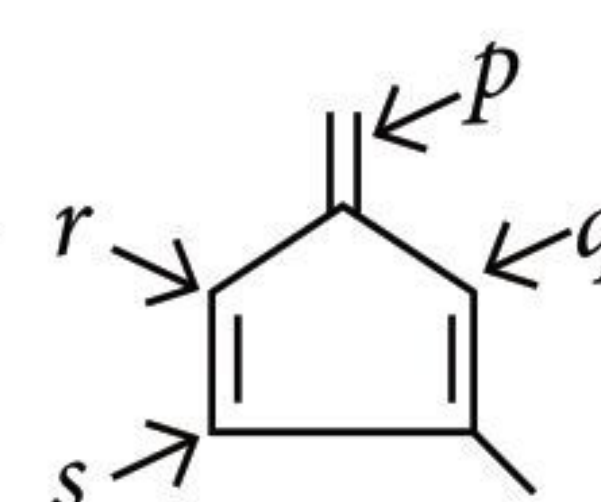
Hydrogenation of the above compound in the presence of poisoned palladium catalyst gives

- (a) an optically active compound
 (b) an optically inactive compound
 (c) a racemic mixture
 (d) a diastereomeric mixture.
10. One litre of a mixture of CO and CO_2 is passed through red hot charcoal in tube. The new volume becomes 1.4 litre. Find out % composition of mixture by volume. All measurements are made at same P and T .
 (a) $\text{CO}_2 = 40\%$, CO = 60%
 (b) $\text{CO}_2 = 60\%$, CO = 40%
 (c) $\text{CO}_2 = 25\%$, CO = 75%
 (d) $\text{CO}_2 = 30\%$, CO = 70%

11. Match the column I with column II and mark the appropriate choice.

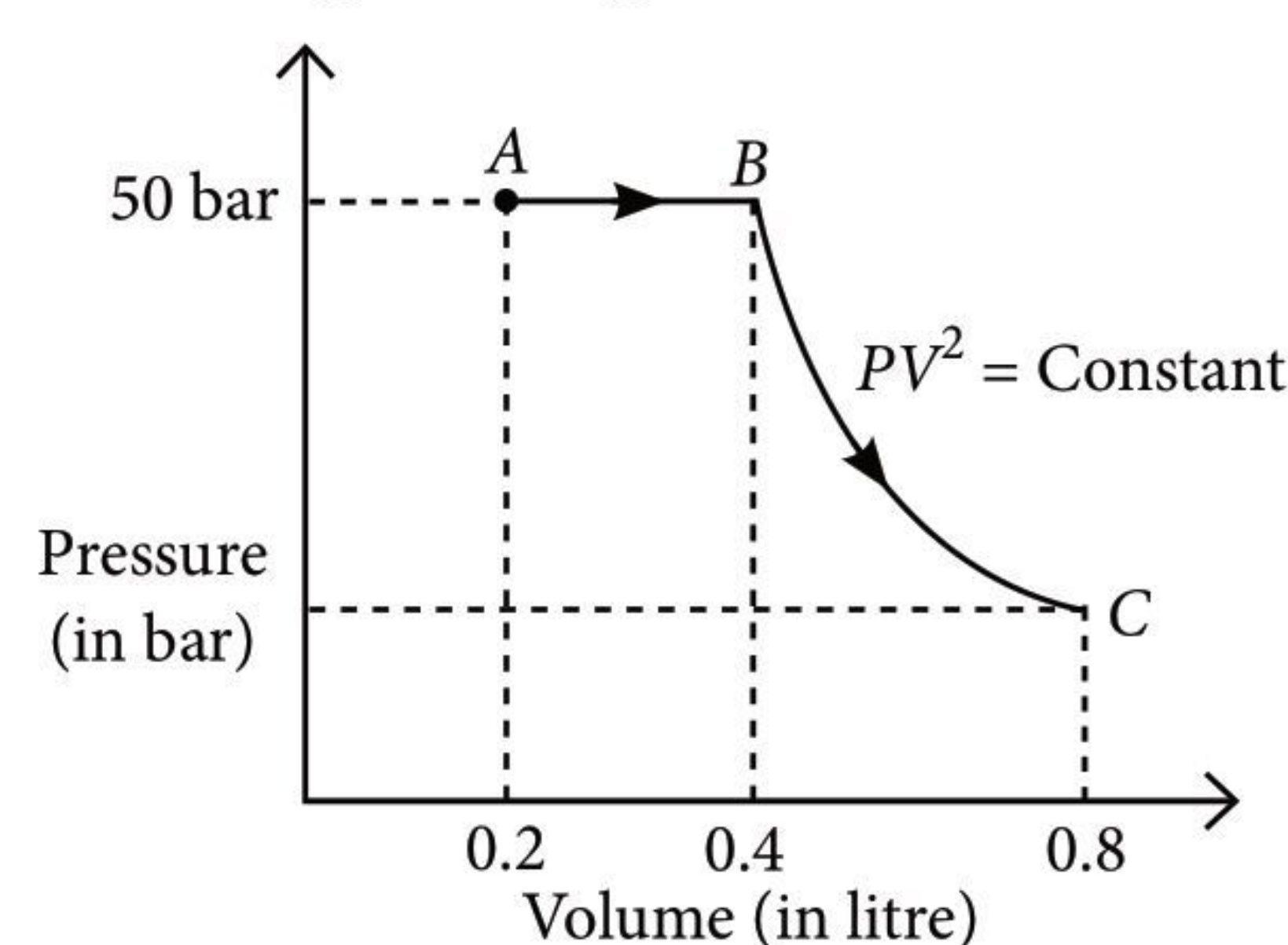
Column I		Column II	
(A)	$\text{CH}_{4(g)} + 2\text{O}_{2(g)} \rightarrow \text{CO}_{2(g)} + 2\text{H}_2\text{O}$	(i)	$\Delta_{\text{sol}}H^\circ$
(B)	$\text{H}_{2(g)} \rightarrow 2\text{H}_{(g)}$	(ii)	$\Delta_{\text{lattice}}H^\circ$
(C)	$\text{NaCl}_{(s)} \rightarrow \text{Na}^+_{(g)} + \text{Cl}^-_{(g)}$	(iii)	Δ_cH°
(D)	$\text{NaCl}_{(s)} \rightarrow \text{Na}^+_{(aq)} + \text{Cl}^-_{(aq)}$	(iv)	$\Delta_{\text{bond}}H^\circ$

- (a) (A) \rightarrow (iv), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (ii)
 (b) (A) \rightarrow (ii), (B) \rightarrow (i), (C) \rightarrow (iv), (D) \rightarrow (iii)
 (c) (A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (iv)
 (d) (A) \rightarrow (iii), (B) \rightarrow (iv), (C) \rightarrow (ii), (D) \rightarrow (i)
12. Which is the most likely protonation site in the conjugated alkene shown below?



- (a) p (b) q
 (c) r (d) s
13. Which of the following is/are not environment friendly reaction(s)?
 (a) $\text{HOCl}_{(g)} \xrightarrow{h\nu} \dot{\text{O}}\text{H} + \dot{\text{Cl}}_{(g)}$
 (b) $\text{CF}_2\text{Cl}_{2(g)} \xrightarrow{h\nu} \dot{\text{Cl}}_{(g)} + \dot{\text{C}}\text{F}_2\text{Cl}_{(g)}$
 (c) $\text{NO} + \text{O}_3 \xrightarrow{\text{Stratosphere}} \text{NO}_2 + \text{O}_2$
 (d) All of these

14. The total work done by a gas (in Joule) if system follows an expansion process as shown in figure is



(Given : 1 bar litre = 100 J)

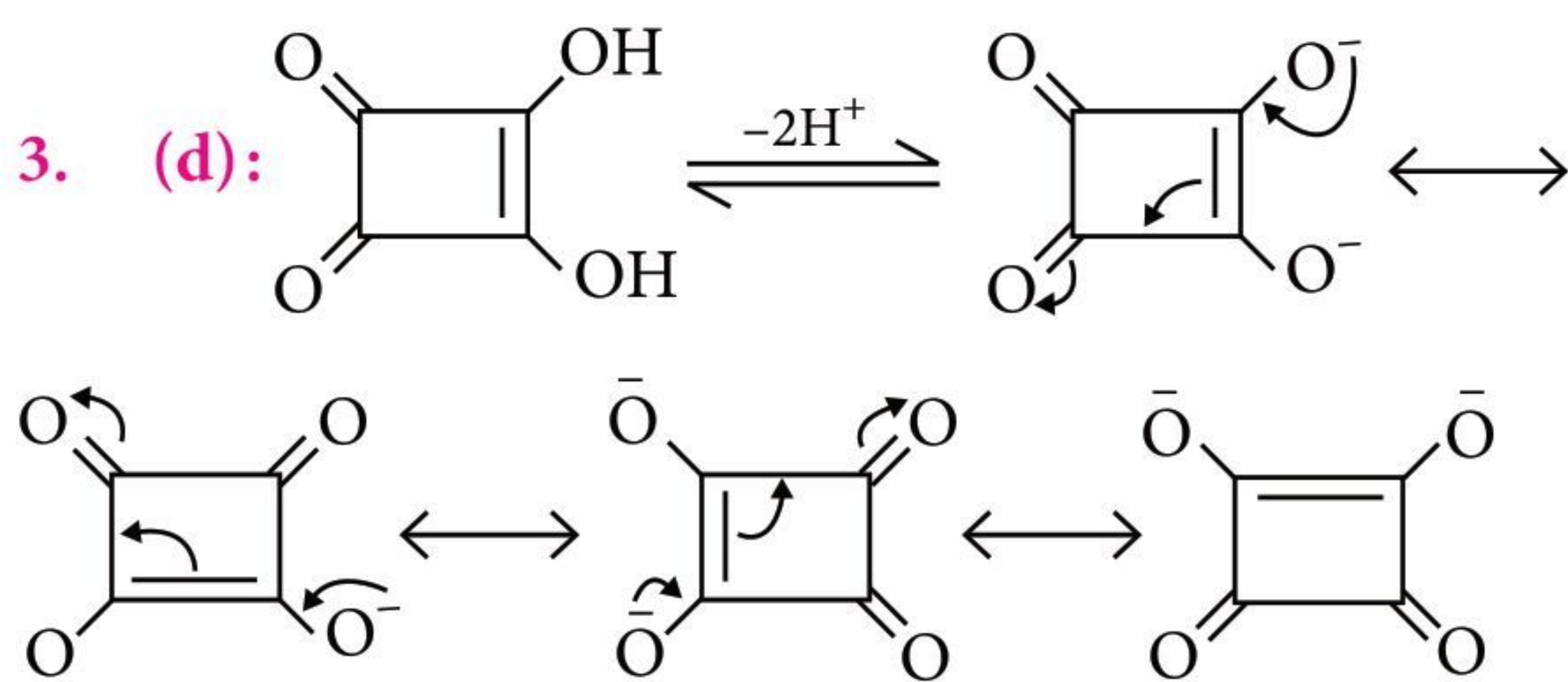
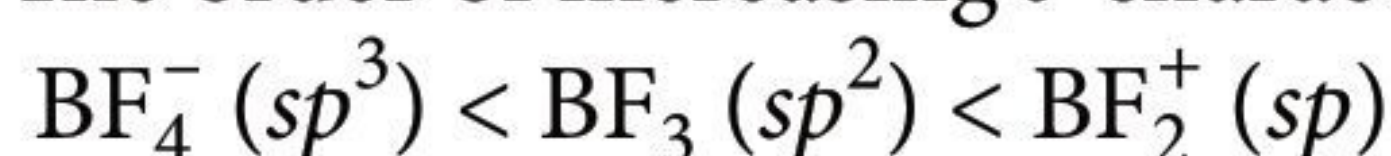
- (a) 2000 J (b) 500 J (c) 1000 J (d) 1500 J
15. What osmotic pressure would the 1.25 molal sucrose solution exhibit at 25°C? The density of this solution is 1.34 g/mL.
 (a) 30.58 atm (b) 28.70 atm
 (c) 1.173 atm (d) 2.90 atm

SOLUTIONS

1. (c)

2. (d): Hybridisation sp^3 sp^2 sp
 % of s -character 25 33 50

∴ The order of increasing s -character

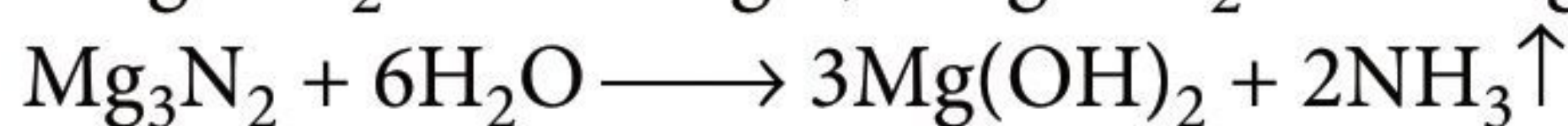
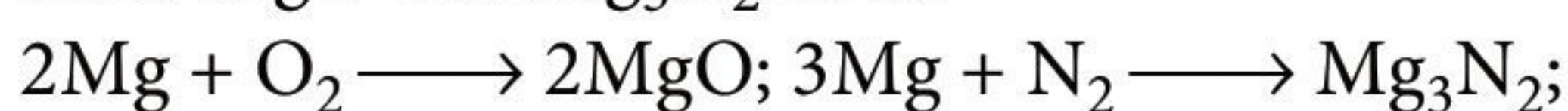


Conjugate base of (I) is stabilised by four equivalent resonance structures whereas (III) is stabilised by only two equivalent resonance structures, therefore (I) is more acidic than (III). Thus the order of acidic strength becomes I > III > II > IV.

4. (a)

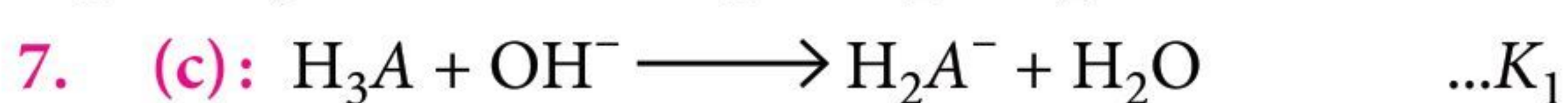
5. (a): Electrical potential gradient due to transfer of K^+ ions cause nerve signals in animals.

6. (c): Mg reacts with O_2 and N_2 present in air to form MgO and Mg_3N_2 both.

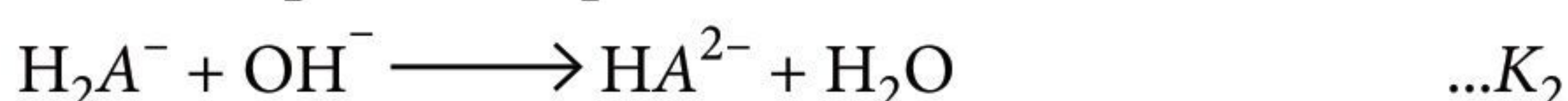


Hydrogen is liberated when Mg reacts with hot water.

Rb, K and Ca gives hydrogen gas even with cold water.



⇒ 1st equivalence point



⇒ 2nd equivalence point



At 2nd equivalence point the species present in appreciable concentration is HA^{2-} (amphiprotic anion).

$$\text{So, the pH} = \frac{1}{2} (pK_2 + pK_3)$$

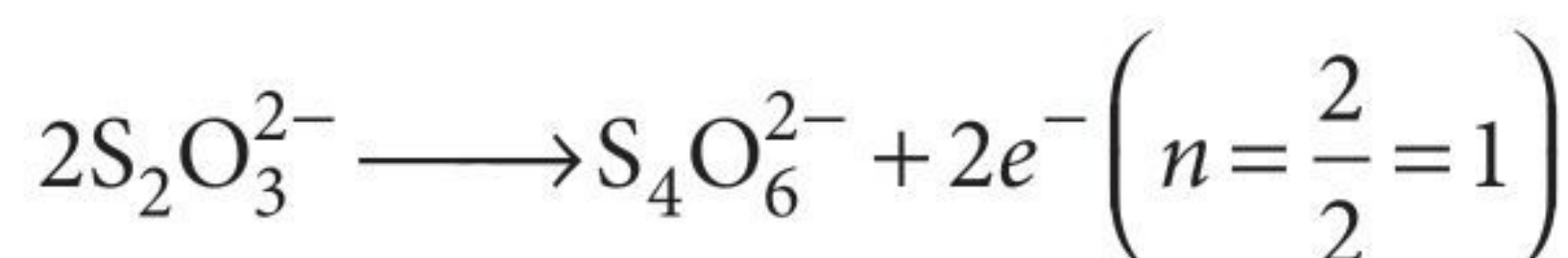
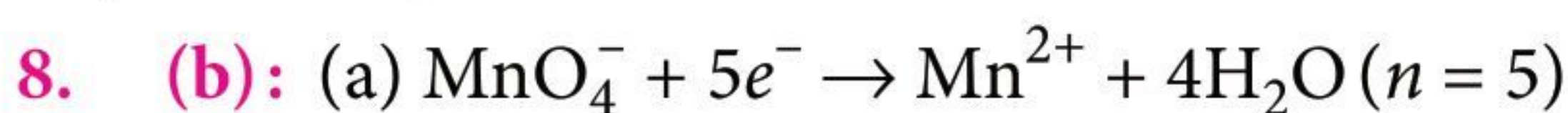
$$= \frac{1}{2} (8 + 12) = 10 \quad [\because K_2 = 10^{-8}, K_3 = 10^{-12}]$$

$$\Rightarrow [H^+] = 10^{-10}$$

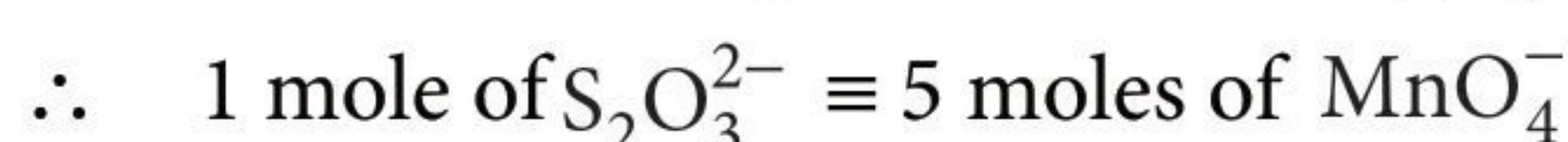
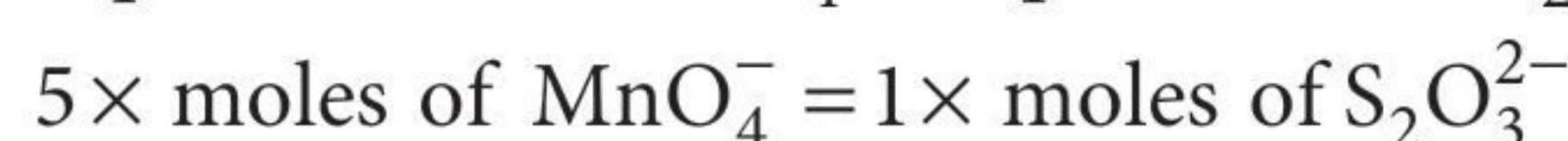
$$K_1 \times K_2 \times K_3 = \frac{[H^+]^3 \times [A^{3-}]}{[H_3A]}$$

$$\Rightarrow \frac{[H_3A]}{[A^{3-}]} = \frac{[H^+]^3}{K_1 \times K_2 \times K_3}$$

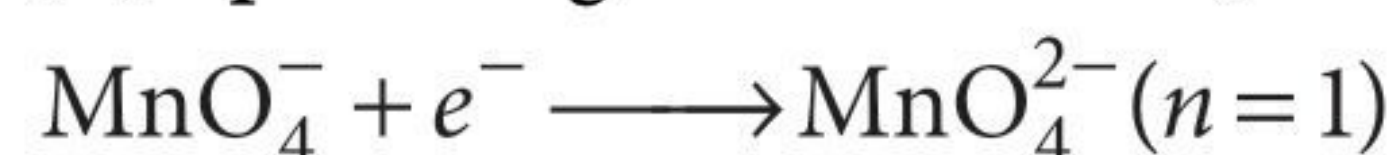
$$= \frac{10^{-30}}{(7.5 \times 10^{-4}) \times 10^{-8} \times 10^{-12}} \approx 10^{-7}$$



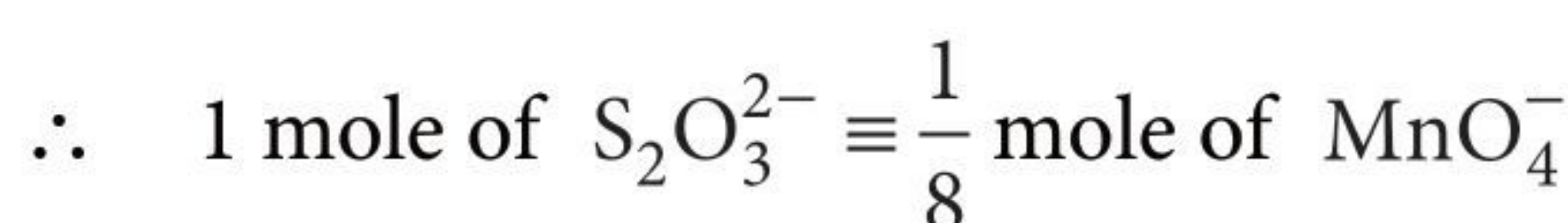
Equivalents of $MnO_4^- \equiv$ Equivalents of $S_2O_3^{2-}$



(b) pH changes from 4 to 10 (acidic to strongly basic)



Equivalents of $MnO_4^- \equiv$ Equivalents of $S_2O_3^{2-}$



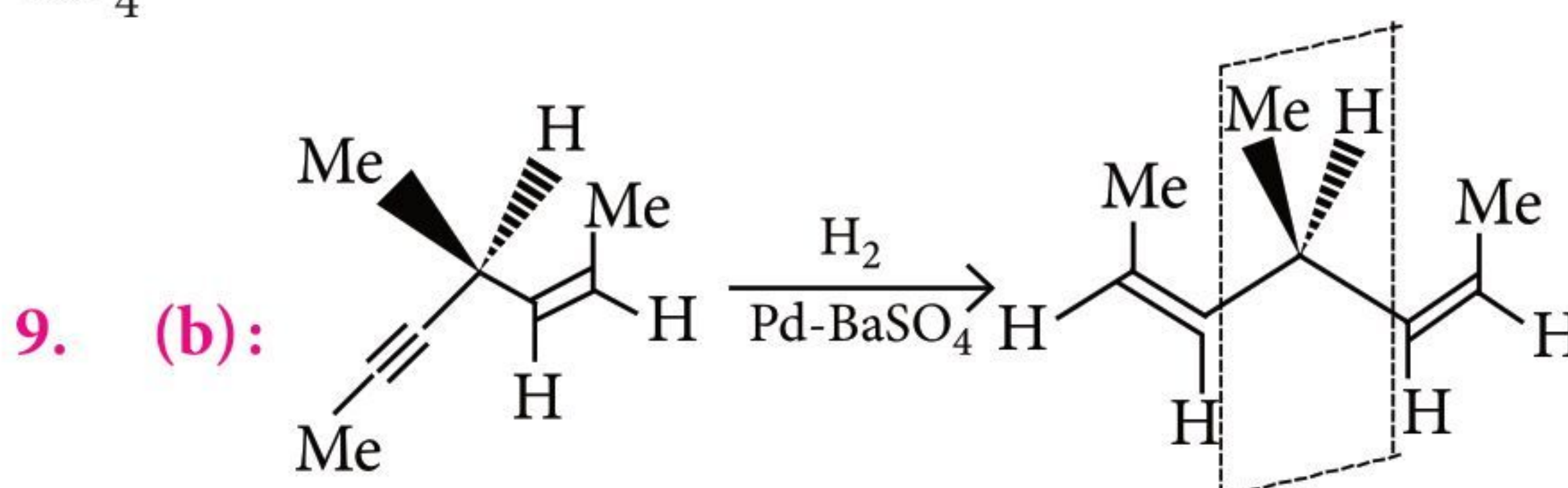
Hence, with change of pH from 4 to 10, will change the stoichiometry of reaction and also changes the product.

(c) pH changes from 4 to 7 (acidic to neutral medium) will change the nature of product.



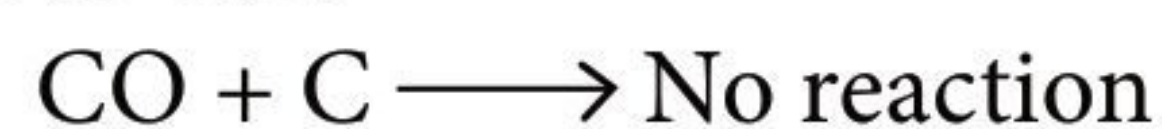
Hence, it will also effect the stoichiometry of reaction and nature of product.

(d) At pH = 9 (basic medium), $S_2O_3^{2-}$ is oxidised to SO_4^{2-} .

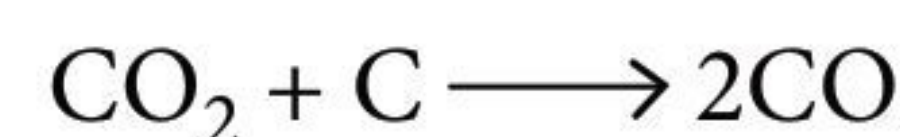


Due to *cis*-addition of H_2 to the triple bond, the reduced product has a plane of symmetry and hence is optically inactive.

10. (a): On passing through charcoal only CO_2 reduces to CO.



Volume a



Volume before reaction : b 0

Volume after reaction : 0 $2b$

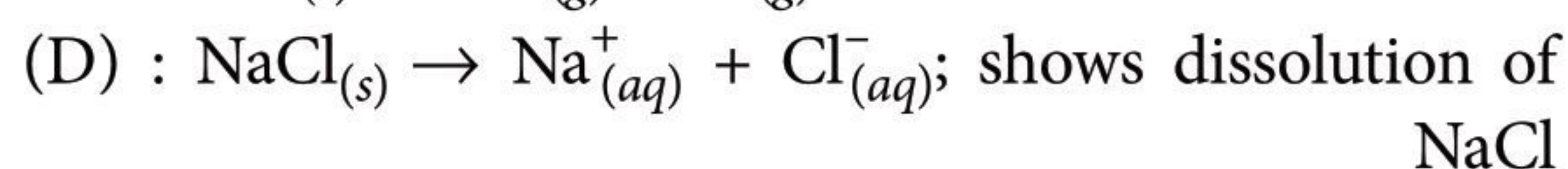
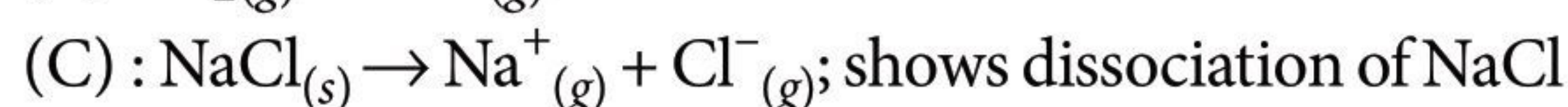
As given : $a + b = 1$ and $a + 2b = 1.4$

$$b = 0.4 \text{ litre} \quad \therefore \quad \% \text{ of } b = \frac{0.4}{1} \times 100 = 40\%$$

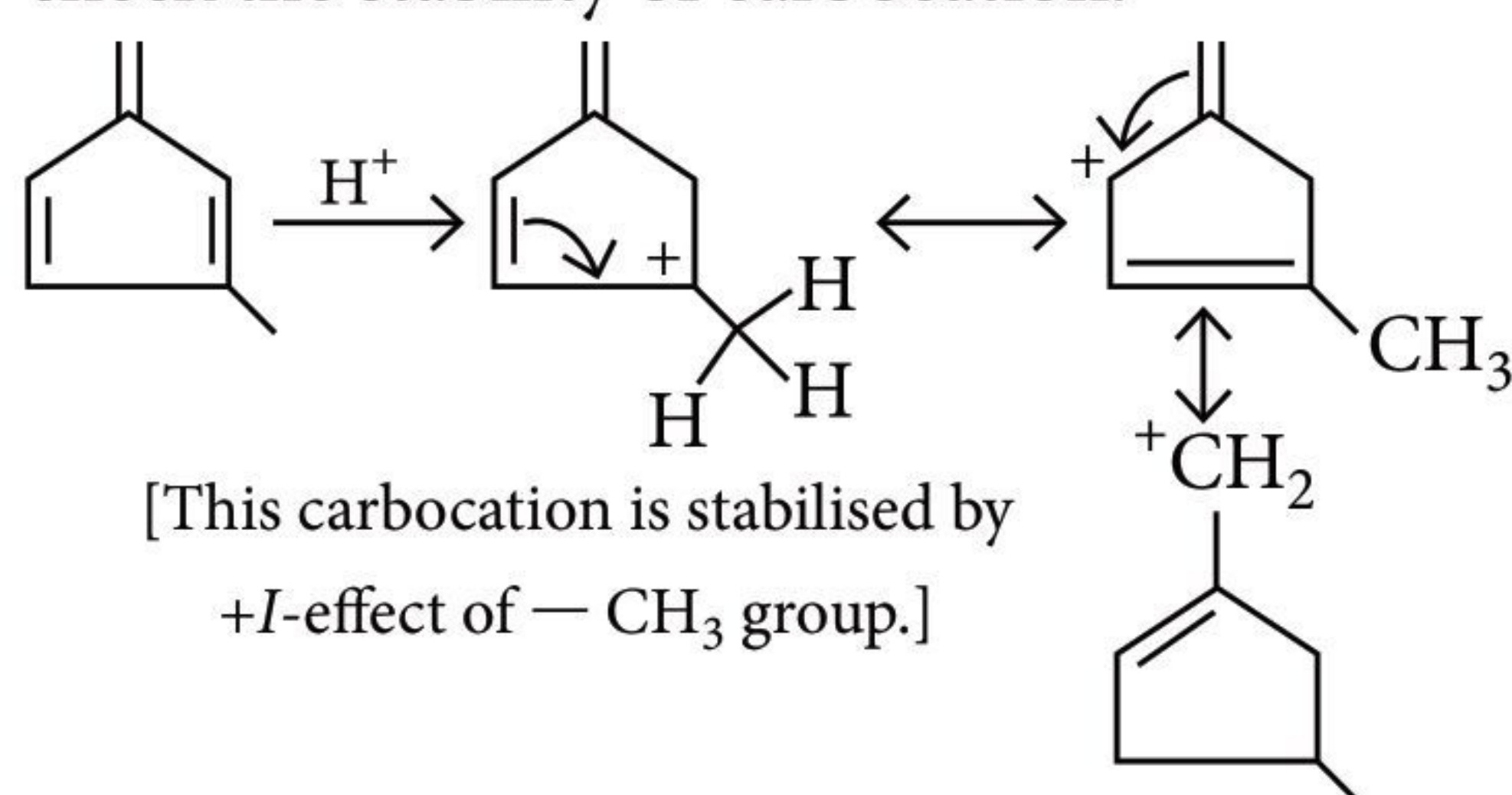
$$a = 0.6 \text{ litre} \quad \therefore \quad \% \text{ of } a = \frac{0.6}{1} \times 100 = 60\%$$



shows combustion reaction



12. (b): After protonation carbocation is formed, check the stability of carbocation.



Extended conjugation makes the carbocation more stable.

13. (d)

14. (a): $P_B V_B^2 = P_C V_C^2$
or $50 \times (0.4)^2 = P_C \times (0.8)^2$

or $P_C = \frac{50 \times 0.4 \times 0.4}{0.8 \times 0.8} = 12.5 \text{ bar}$

$w = w_{AB} + w_{BC}$

$= -50(0.4 - 0.2) + \frac{P_C V_C - P_B V_B}{2 - 1}$

$= -50 \times 0.2 + \frac{12.5 \times 0.8 - 50 \times 0.4}{1}$

$= -10 + (-10) = -20 \text{ bar litre} = -2000 \text{ J}$

Work done = 2000 J

15. (b): Molality = $\frac{1000M}{(1000d - Mm_1)}$

where m_1 = Molar mass of the solute

M = Molarity

d = density of the solution

$1.25 = \frac{1000M}{(1000 \times 1.34 - 342M)} \Rightarrow 1.25 = \frac{1000M}{(1340 - 342M)}$

$\frac{1000M}{1.25} = 1340 - 342M$

$M = 1.173 \text{ mol L}^{-1}$

Thus, $\pi = MRT = 1.173 \times 0.0821 \times 298 = 28.70 \text{ atm}$

Scientist of the Month

Svante August Arrhenius

Early Life and Education

- Arrhenius was born on 19 February 1859 at United Kingdoms of Sweden and Norway. At the age of three, Arrhenius taught himself to read without the encouragement of his parents and by watching his father's addition of numbers in his account books, became an arithmetical prodigy. In later life, Arrhenius was profoundly passionate about mathematical concepts, data analysis and discovering their relationships and laws.

At age eight, he entered the local cathedral school, starting in the fifth grade, distinguishing himself in physics and mathematics, and graduating as the youngest and most able student in 1876.

In 1885, Arrhenius next received a travel grant from the Swedish Academy of Sciences, which enabled him to study with Ostwald in Riga (now in Latvia), with Friedrich Kohlrausch in Würzburg, Germany, with Ludwig Boltzmann in Graz, Austria, and with van't Hoff in Amsterdam.



Svante August Arrhenius
(19 Feb. 1859 - 02 Oct. 1927)

In 1889, Arrhenius explained the fact that most reactions require added heat energy to proceed by formulating the concept of activation energy, an energy barrier that must be overcome before two molecules will react.

In 1891, he became a lecturer at the Stockholm University College (Stockholms Högskola, now Stockholm University), being promoted to professor of physics (with much opposition) in 1895, and rector in 1896.

Awards and Honors

- About 1900, Arrhenius became involved in setting up the Nobel Institutes and the Nobel Prizes.
- He was elected a member of the Royal Swedish Academy of Sciences in 1901. For the rest of his life, he would be a member of the Nobel Committee on Physics and a de facto member of the Nobel Committee on Chemistry.
- In 1901 Arrhenius was elected to the Swedish Academy of Sciences, against strong opposition.
- In 1903 he became the first Swede to be awarded the Nobel Prize in Chemistry.
- In 1905, upon the founding of the Nobel Institute for Physical Research at Stockholm, he was appointed rector of the institute, the position where he remained until retirement in 1927.
- In 1911, he won the first Willard Gibbs Award.

WHAT IS AVAXHOME?

AVAXHOME-

the biggest Internet portal,
providing you various content:
brand new books, trending movies,
fresh magazines, hot games,
recent software, latest music releases.

Unlimited satisfaction one low price

Cheap constant access to piping hot media

Protect your downloadings from Big brother

Safer, than torrent-trackers

18 years of seamless operation and our users' satisfaction

All languages

Brand new content

One site



AVXLIVE . ICU

AvaxHome - Your End Place

We have everything for all of your needs. Just open <https://avxlive.icu>

BRUSH UP ^{for} NEET/JEE

CLASS-XI

Brush up your concepts to get high rank in NEET/JEE (Main and Advanced) by reading this column. This specially designed column is updated year after year by a panel of highly qualified teaching experts well-tuned to the requirements of these Entrance Tests.

Unit
6

The *p*-Block Elements (Group 13 & 14)

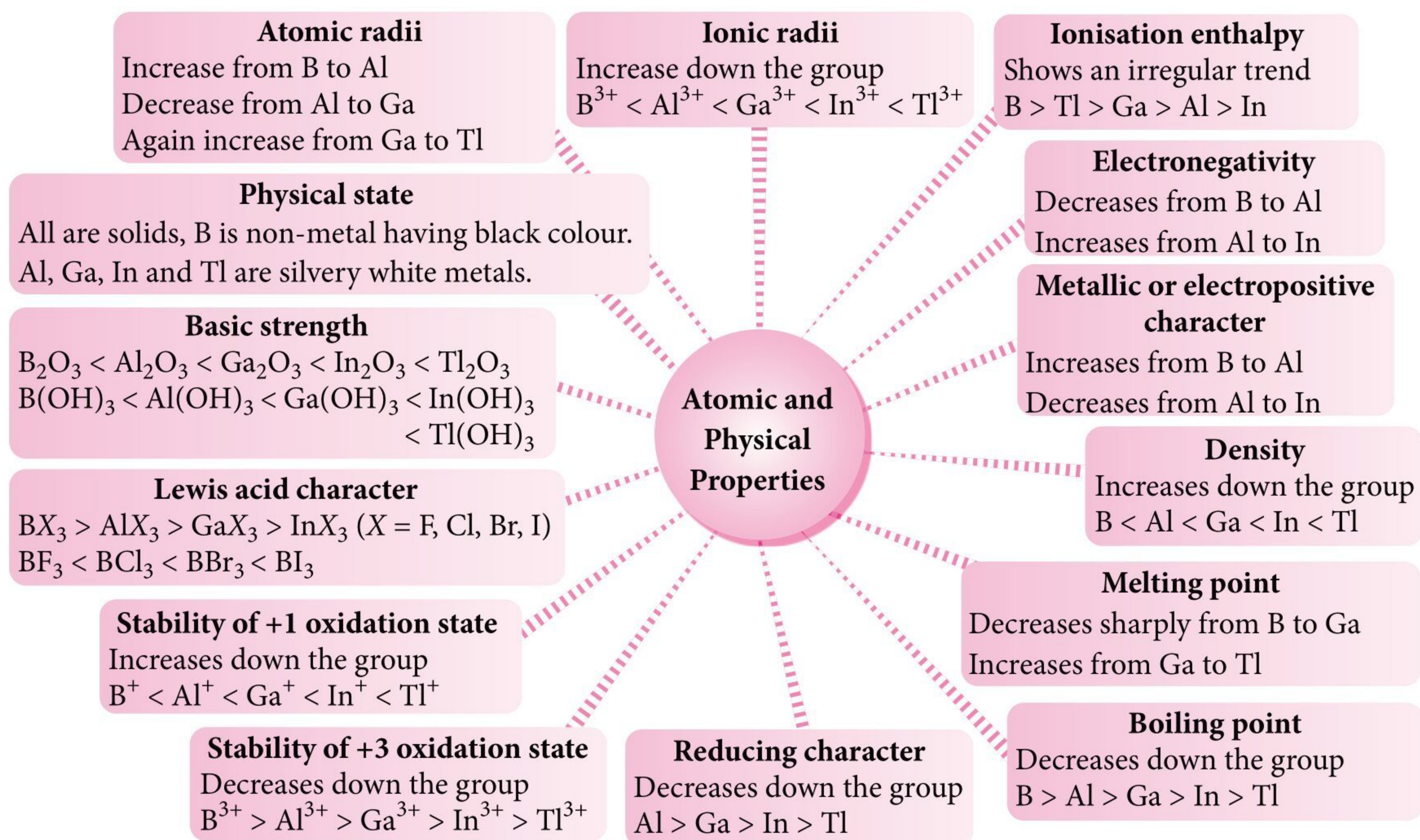
INTRODUCTION

- Elements having outer electronic configuration of the type $ns^2 np^1$ to $ns^2 np^6$, with all other inner orbitals completely filled, are termed as *p*-block elements. In other words, the elements in which the last electron enters into any of the outermost *p*-orbitals (group 13 to 18) are called *p*-block elements. Thus, the general outer electronic configuration of the *p*-block elements is $ns^2 np^{1-6}$.

PHYSICAL PROPERTIES

GROUP-13 ELEMENTS : BORON FAMILY

- Group-13 of periodic table contains six elements, Boron (B), Aluminium (Al), Gallium (Ga), Indium (In), Thallium (Tl) and Nihonium (Nh).
- General electronic configuration :** $ns^2 np^1$
- Electronic configuration :** B(5) : $[\text{He}]2s^2 2p^1$, Al(13) : $[\text{Ne}]3s^2 3p^1$, Ga(31) : $[\text{Ar}]3d^{10} 4s^2 4p^1$; In(49) : $[\text{Kr}]4d^{10} 5s^2 5p^1$, Tl(81) : $[\text{Xe}]4f^{14} 5d^{10} 6s^2 6p^1$; Nh(113) : $[\text{Rn}]5f^{14} 6d^{10} 7s^2 7p^1$



TRENDS IN CHEMICAL PROPERTIES

• Oxides and hydroxides :

All the elements of group 13 form oxides with formula M_2O_3 and hydroxides with formula $M(OH)_3$. Reactivity of these elements towards oxygen increases down the group.

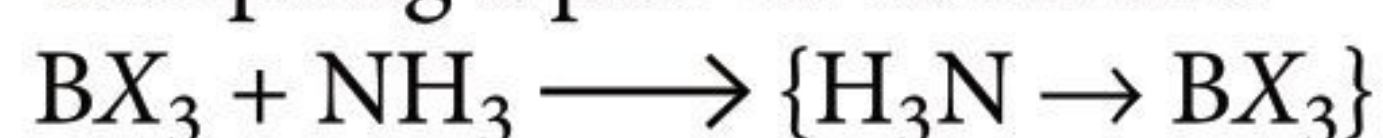
Oxides	Hydroxides	Nature
B_2O_3	$B(OH)_3$	Acidic
Al_2O_3	$Al(OH)_3$	Amphoteric
Ga_2O_3	$Ga(OH)_3$	Amphoteric
In_2O_3	$In(OH)_3$	Basic
Tl_2O_3	$Tl(OH)_3$	Strongly basic

As we move down the group, the atomic size of elements goes on increasing whereas, the ionisation energy decreases. As a result, the strength of $M-O$ bond goes on decreasing accounting for the increase in basic character down the group or conversely explains the decrease in acidic character.

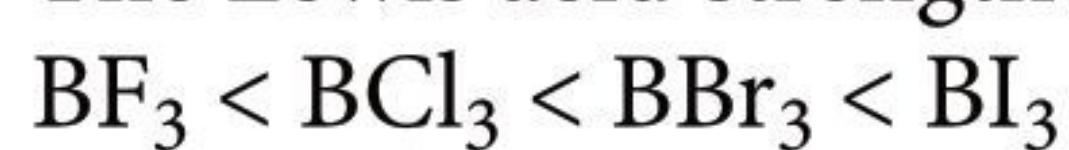
• Halides :

Group 13 elements form trihalides(MX_3). Monohalides of thallium are also given as TlF , $TlCl$, $TlBr$ and TlI .

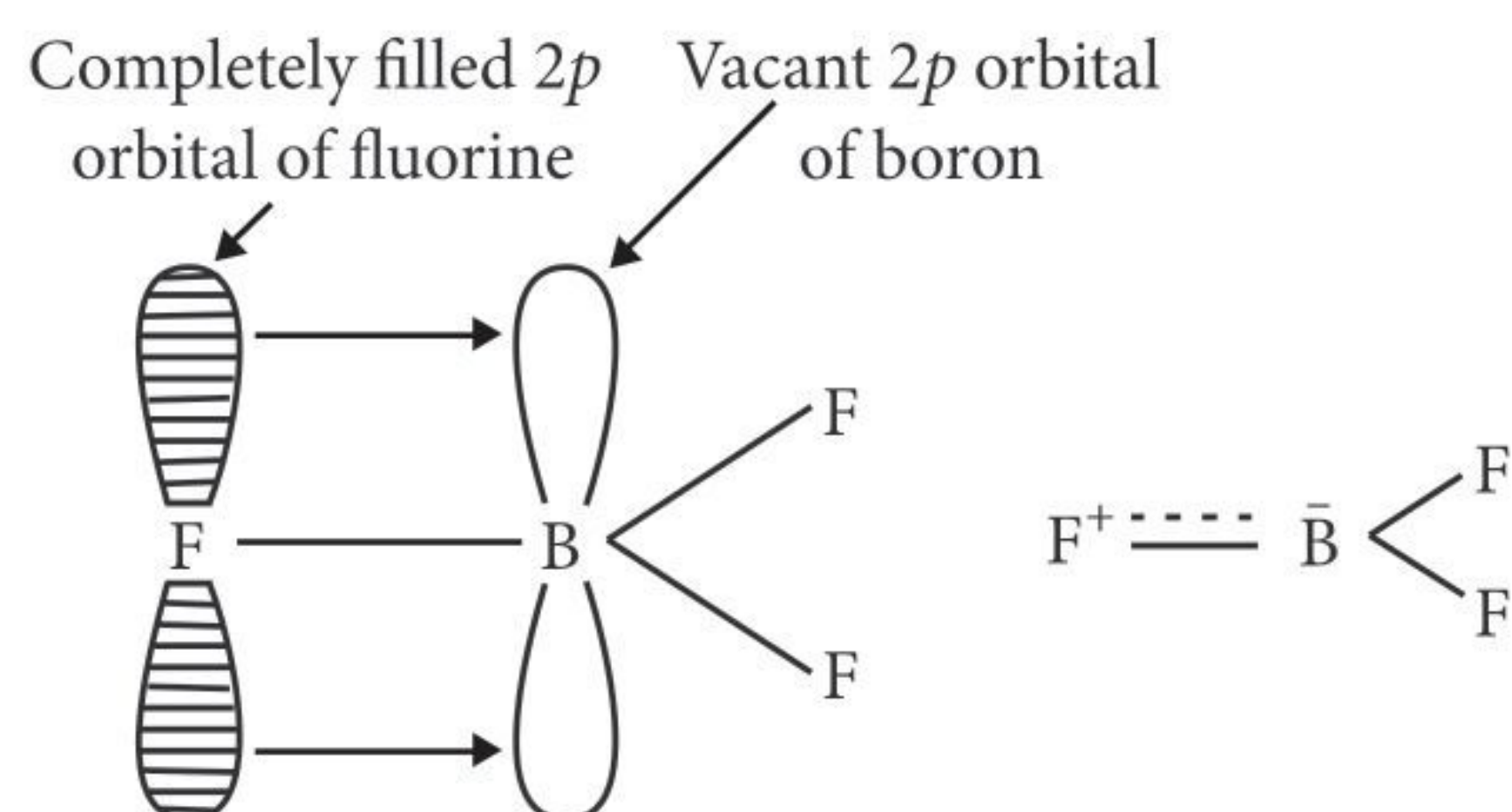
- Due to small size and high electronegativity, all boron halides are covalent and sp^2 -hybridised.
- Boron halides BX_3 are electron deficient compounds having six electrons in the outermost orbit thus act as Lewis acid by accepting a pair of electrons.



The Lewis acid strength follows the order :



This order can be explained on the basis of back bonding or back donation. In BF_3 , there is donation of electron from filled $2p$ -orbitals of fluorine to a vacant $2p$ -orbital of B.

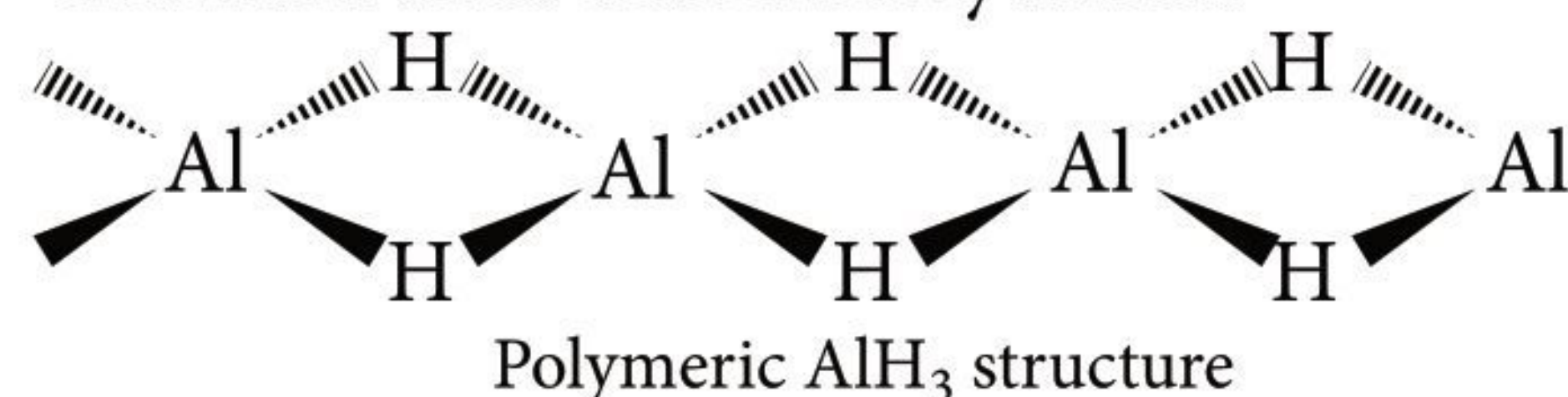


Thus, B-F bond has some double bond character.

- Lewis acid character of halides of group 13 elements decreases in the order :
 $BX_3 > AlX_3 > GaX_3 > InX_3$

• Hydrides :

- None of the group 13 elements react directly with hydrogen. However a number of hydrides of these elements are known.
- Boron forms a number of stable covalent hydrides with general formula B_nH_{n+4} (nido-boranes e.g., B_2H_6) and B_nH_{n+6} (arachno-boranes e.g., B_4H_{10}). These are called boranes and are electron deficient compounds.
- The simplest and most important boron hydride is diborane (B_2H_6).
- Other members of this group also form a stable hydride but they are polymeric in nature e.g., $(AlH_3)_n$, $(GaH_3)_n$, $(InH_3)_n$ and contain $M-H_b-M$ bridge bond. Their stability decreases as we move down the group due to corresponding decrease in strength of $M-H$ bond as the size of atom increases.
- Thallium does not form hydrides.



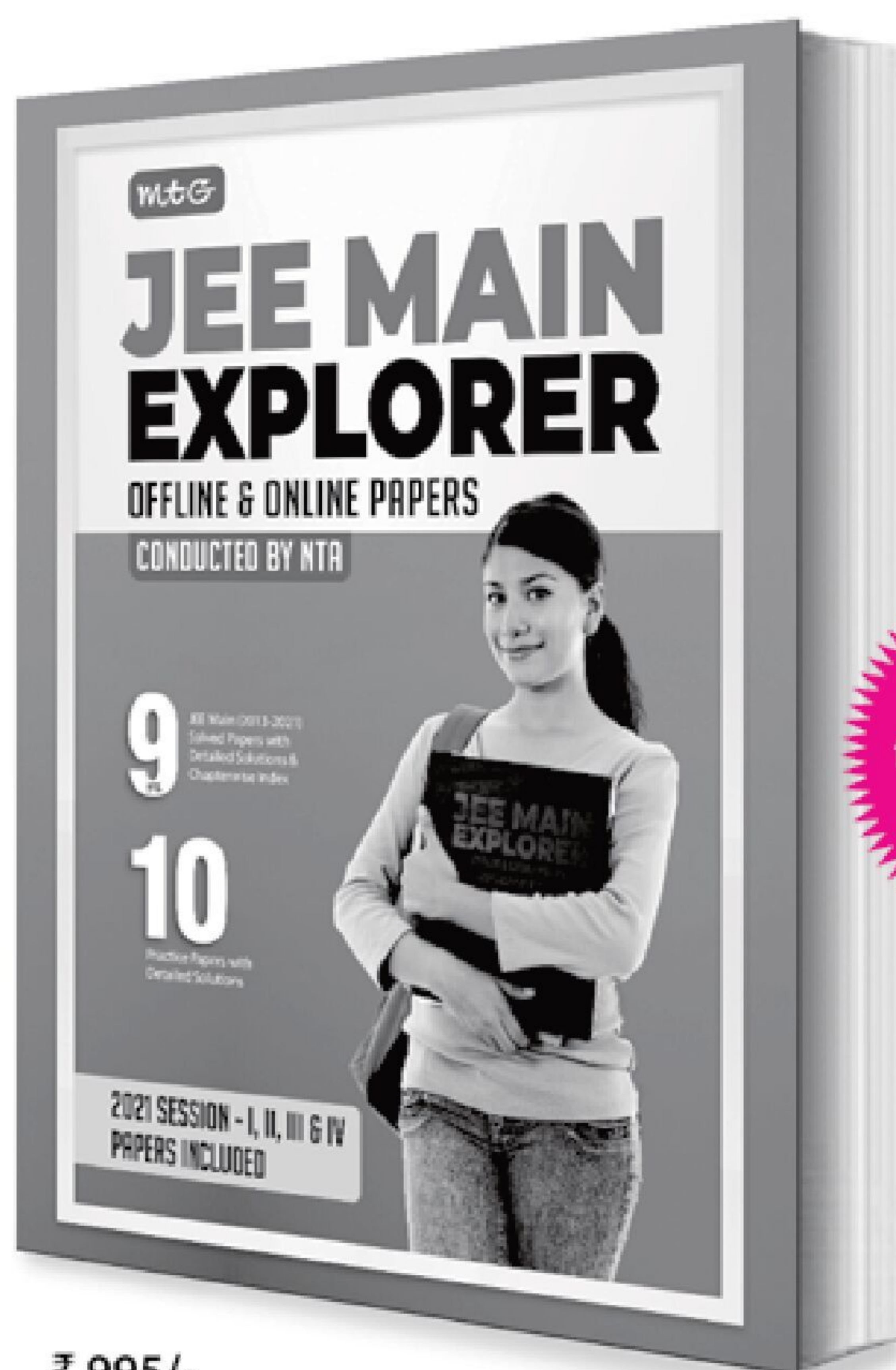
• Carbides :

- Boron and aluminium on heating with carbon at high temperature form carbides.
 $4B + C \xrightarrow{2500^\circ C} B_4C$, $4Al + 3C \xrightarrow{1000^\circ C} Al_4C_3$
- Boron carbide is covalent in nature.
- Aluminium carbide is ionic carbide. On hydrolysis it gives methane, hence it is sometimes called as aluminium methanide.
 $Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3 + 3CH_4 \uparrow$

ANOMALOUS BEHAVIOUR OF BORON

- Boron shows anomalous behaviour due to its small size, high nuclear charge, high electronegativity and non-availability of d -electrons.
- The main points of differences are as follows :
 - Boron is a typical non-metal whereas other members are metals.
 - It alone exhibits allotropy.
 - It is a bad conductor of electricity whereas others are good conductors.
 - It forms only covalent compounds whereas other elements form some ionic compounds too.
 - Hydroxides and oxides of boron are weakly acidic in nature whereas those of others are amphoteric and basic in nature.

What is JEE (MAIN) like?



₹ 995/-

Visit
www.mtg.in
for latest offers
and to buy
online!

Thinking about competing in the JEE? Unsure of what it's like? Get a first-hand feel with MTG's JEE Main Explorer. With solved papers from the past 9 years, glance through the changing pattern of examination. Or attempt the papers to check your chances of success. Either way, at ₹ 995, isn't this a steal for JEE aspirants like you? So what are you waiting for? Order MTG's JEE Main Explorer today.



Scan now with your
smartphone or tablet
Application to read
QR codes required

Available at all leading book shops throughout the country. To buy online visit www.mtg.in.

For more information or for help in placing your order, call 0124-6601200 or email: info@mtg.in

- The trihalides of boron (BX_3) exist as monomer whereas others exist as dimers.

- It exhibits maximum covalency of 4 while others exhibit a maximum covalency of 6.

SOME IMPORTANT COMPOUNDS OF BORON AND ALUMINIUM

	Preparation	Properties	Structure
Borax ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$)	$\text{Ca}_2\text{B}_6\text{O}_{11} + 2\text{Na}_2\text{CO}_3 \xrightarrow{\Delta} \text{Na}_2\text{B}_4\text{O}_7 + 2\text{NaBO}_2 + 2\text{CaCO}_3$ <p style="text-align: center;">Colemanite</p> $4\text{NaBO}_2 + \text{CO}_2 \longrightarrow \text{Na}_2\text{B}_4\text{O}_7 + \text{Na}_2\text{CO}_3$ $4\text{H}_3\text{BO}_3 + \text{Na}_2\text{CO}_3 \xrightarrow{\Delta} \text{Na}_2\text{B}_4\text{O}_7 + 6\text{H}_2\text{O} + \text{CO}_2$	$\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O} \xrightarrow{\Delta} \text{Na}_2\text{B}_4\text{O}_7 + 10\text{H}_2\text{O}$ $\text{Na}_2\text{B}_4\text{O}_7 \xrightarrow{\Delta} 2\text{NaBO}_2 + \text{B}_2\text{O}_3$ <p style="text-align: center;">Transparent glassy bead</p> $\text{Na}_2\text{B}_4\text{O}_7 + 2\text{NaOH} \longrightarrow 4\text{NaBO}_2 + \text{H}_2\text{O}$ $\text{Na}_2\text{B}_4\text{O}_7 + \text{H}_2\text{SO}_4 + 5\text{H}_2\text{O} \longrightarrow \text{Na}_2\text{SO}_4 + 4\text{H}_3\text{BO}_3$	
	Uses : <ul style="list-style-type: none"> • It is used as water softener and cleansing agent. • In the laboratory it is used for borax bead test. 		
Orthoboric acid (H_3BO_3)	$\text{Na}_2\text{B}_4\text{O}_7 + 2\text{HCl} + 5\text{H}_2\text{O} \longrightarrow 4\text{H}_3\text{BO}_3 + 2\text{NaCl}$ $\text{Na}_2\text{B}_4\text{O}_7 + \text{H}_2\text{SO}_4 + 5\text{H}_2\text{O} \longrightarrow 4\text{H}_3\text{BO}_3 + \text{Na}_2\text{SO}_4$ $\text{Ca}_2\text{B}_6\text{O}_{11} + 4\text{SO}_2 + 11\text{H}_2\text{O} \longrightarrow 2\text{Ca}(\text{HSO}_3)_2 + 6\text{H}_3\text{BO}_3$ $\text{B}_2\text{H}_6 + 6\text{H}_2\text{O} \longrightarrow 2\text{H}_3\text{BO}_3 + 6\text{H}_2$ $\text{BN} + 3\text{H}_2\text{O} \longrightarrow \text{H}_3\text{BO}_3 + \text{NH}_3$	$\text{H}-\text{OH} + \text{B}(\text{OH})_3 \longrightarrow [\text{B}(\text{OH})_4]^- + \text{H}^+ ; \quad \text{p}K_a = 9.25$ $\text{H}_3\text{BO}_3 \xrightarrow{370 \text{ K}} \text{HBO}_2 + \text{H}_2\text{O}$ $\xrightarrow[410 \text{ K}]{-\text{H}_2\text{O}} \text{H}_2\text{B}_4\text{O}_7 \xrightarrow{\text{Red heat}} 2\text{B}_2\text{O}_3 + \text{H}_2\text{O}$ $\text{B}(\text{OH})_3 + 3\text{C}_2\text{H}_5\text{OH} \xrightarrow{\text{Conc. H}_2\text{SO}_4} \text{B}(\text{OC}_2\text{H}_5)_3 + 3\text{H}_2\text{O}$ <p style="text-align: center;">Ethyl borate</p>	
	Uses : <ul style="list-style-type: none"> • It is used in the manufacture of heat resistant borosilicate glass. • The aqueous solution of boric acid is used as a mild antiseptic especially as eye wash under the name <i>boric lotion</i>. 		
Diborane (B_2H_6)	$2\text{NaBH}_4 + \text{I}_2 \xrightarrow{\text{Diglyme}} \text{B}_2\text{H}_6 + 2\text{NaI} + \text{H}_2$ $2\text{BF}_3 + 6\text{NaH} \xrightarrow{450 \text{ K}} \text{B}_2\text{H}_6 + 6\text{NaF}$ $4\text{BF}_3 \cdot \text{Et}_2\text{O} + 3\text{LiAlH}_4 \xrightarrow{\text{Diethyl ether}} 2\text{B}_2\text{H}_6 + 3\text{LiF} + 3\text{AlF}_3 + 4\text{Et}_2\text{O}$	$\text{B}_2\text{H}_6 + 3\text{O}_2 \longrightarrow \text{B}_2\text{O}_3 + 3\text{H}_2\text{O}; \quad \Delta_c H^\circ = -1976 \text{ kJ mol}^{-1}$ $\text{B}_2\text{H}_6 + 6\text{H}_2\text{O} \longrightarrow 2\text{H}_3\text{BO}_3 + 6\text{H}_2$ $\text{B}_2\text{H}_6 + 6\text{CH}_3\text{OH} \longrightarrow 2\text{B}(\text{OCH}_3)_3 + 6\text{H}_2$ $\text{B}_2\text{H}_6 + 2\text{NaH} \xrightarrow{\text{Diethyl ether}} 2\text{NaBH}_4$ $\text{B}_2\text{H}_6 + 2\text{LiH} \xrightarrow{\text{Diethyl ether}} 2\text{LiBH}_4$ $\text{B}_2\text{H}_6 + 2\text{KOH} + 2\text{H}_2\text{O} \longrightarrow 2\text{KBO}_2 + 6\text{H}_2$ $\text{B}_2\text{H}_6 + 2\text{NMe}_3 \longrightarrow 2\text{BH}_3 \cdot \text{NMe}_3$ $3\text{B}_2\text{H}_6 + 6\text{NH}_3 \xrightarrow{\text{low temp.}} 3[\text{BH}_2(\text{NH}_3)_2]^+ [\text{BH}_4]^- \xrightarrow{473 \text{ K}} 2\text{B}_3\text{N}_3\text{H}_6 + 12\text{H}_2$ <p style="text-align: center;">Borazine</p>	
	Uses : <ul style="list-style-type: none"> • It is used for preparing a number of borohydrides such as LiBH_4, NaBH_4, etc. • It is used as a reducing agent in organic reactions. 		

Aluminium chloride (AlCl ₃)	$2\text{Al} + 3\text{Cl}_2 \longrightarrow 2\text{AlCl}_3$ $2\text{Al} + 6\text{HCl} \longrightarrow 2\text{AlCl}_3 + 3\text{H}_2\uparrow$ $\text{Al}_2\text{O}_3 + 3\text{C} + 3\text{Cl}_2 \xrightarrow{100^\circ\text{C}} 2\text{AlCl}_3 + 3\text{CO}$ <p style="text-align: center;">(Vapours)</p>	<p>Anhydrous AlCl₃ fumes in moist air due to hydrolysis and the resulting solution is acidic.</p> $\text{AlCl}_3 + 3\text{H}_2\text{O} \longrightarrow \text{Al}(\text{OH})_3 + 3\text{HCl}$ $\text{AlCl}_3 + 3\text{NH}_4\text{OH} \longrightarrow \text{Al}(\text{OH})_3\downarrow + 3\text{NH}_4\text{Cl}$ <p style="text-align: center;">Gelatinous ppt. (Insoluble in excess NH₄OH)</p> $\text{AlCl}_3 + 3\text{NaOH} \longrightarrow \text{Al}(\text{OH})_3\downarrow + 3\text{NaCl}$ <p style="text-align: center;">(Soluble in excess NaOH)</p> $\text{Al}(\text{OH})_3 + \text{NaOH} \longrightarrow \text{NaAlO}_2 + 2\text{H}_2\text{O}$ <p style="text-align: center;">(Sodium metaaluminate)</p>	
	Uses : <ul style="list-style-type: none"> Anhydrous AlCl₃ is used as a catalyst in Friedel-Crafts' reaction and in cracking of petroleum. 		

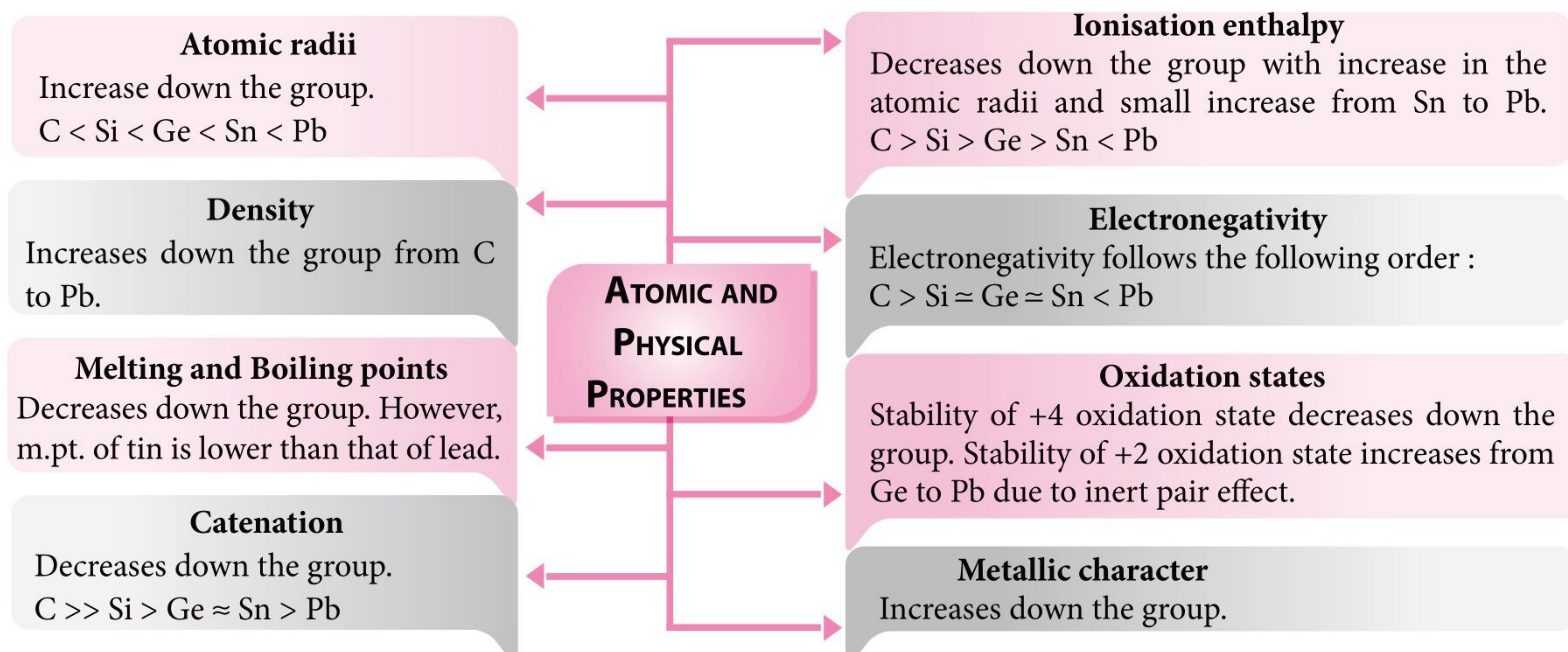
ALUMS

- These are double sulphates with general formula, $M_2\text{SO}_4 \cdot M'_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$ where M stands for a monovalent metal or radical, e.g., Na⁺, K⁺, NH₄⁺, etc., while M' stands for a trivalent metal, e.g., Al³⁺, Cr³⁺, Fe³⁺, etc.
Ammonia alum, (NH₄)₂SO₄ · Al₂(SO₄)₃ · 24H₂O
Chrome alum, K₂SO₄ · Cr₂(SO₄)₃ · 24H₂O
Ferric alum, (NH₄)₂SO₄ · Fe₂(SO₄)₃ · 24H₂O
Sodium alum, Na₂SO₄ · Al₂(SO₄)₃ · 24H₂O
Potash alum, K₂SO₄ · Al₂(SO₄)₃ · 24H₂O

GROUP 14 ELEMENTS : CARBON FAMILY

- Group 14 of the periodic table contains six elements, Carbon (C), Silicon (Si), Germanium (Ge), Tin (Sn), Lead (Pb) and Flerovium (Fl).
- General electronic configuration :** ns^2np^2
- Electronic configuration :** C(6) : [He]2s²2p², Si(14) : [Ne]3s²3p², Ge(32) : [Ar]3d¹⁰4s²4p², Sn(50) : [Kr]4d¹⁰5s²5p², Pb(82) : [Xe]4f¹⁴5d¹⁰6s²6p², Fl(114) : [Rn]5f¹⁴6d¹⁰7s²7p²

PHYSICAL PROPERTIES



CHEMICAL PROPERTIES

- Hydrides :** All members of the group form covalent hydrides. Their number and ease of

formation decreases down the group. Hydrides of carbon are called *hydrocarbons* (alkanes, alkenes or alkynes). Hydrides of Si and Ge are known

as *silanes* and *germanes*. The only hydrides of Sn and Pb are SnH_4 (stannane) and PbH_4 (plumbane).

- Their thermal stability decreases down the group.
- Their reducing character increases down the group.

- **Halides** : All the elements give tetrahedral and covalent halides of the type MX_4 except PbBr_4 and PbI_4 .

Thermal stability: $\text{CX}_4 > \text{SiX}_4 > \text{GeX}_4 > \text{SnX}_4 > \text{PbX}_4$

Order of thermal stability with common metals :

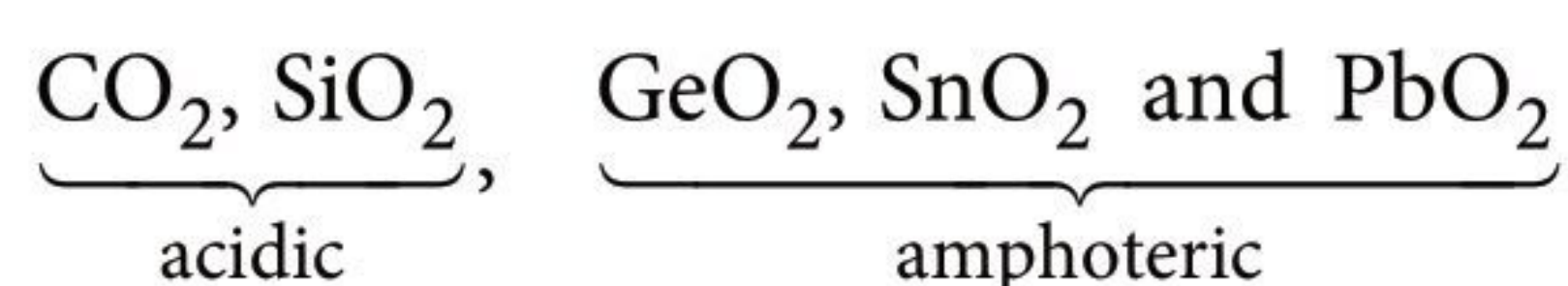
$\text{MF}_4 > \text{MCl}_4 > \text{MBr}_4 > \text{MI}_4$

Except CX_4 other tetrahalides can be hydrolysed due to the presence of vacant *d*-orbitals.

$\text{SiX}_4 + 2\text{H}_2\text{O} \longrightarrow \text{SiO}_2 + 4\text{HX}$

Ease of hydrolysis : $\text{SiX}_4 > \text{GeX}_4 > \text{SnX}_4 > \text{PbX}_4$

- **Oxides** : They form two types of oxides, monoxides of the type MO and dioxides of the type MO_2 .



SiO_2 is a solid with three dimensional network in which Si is bonded to four oxygen atoms tetrahedrally and covalently.

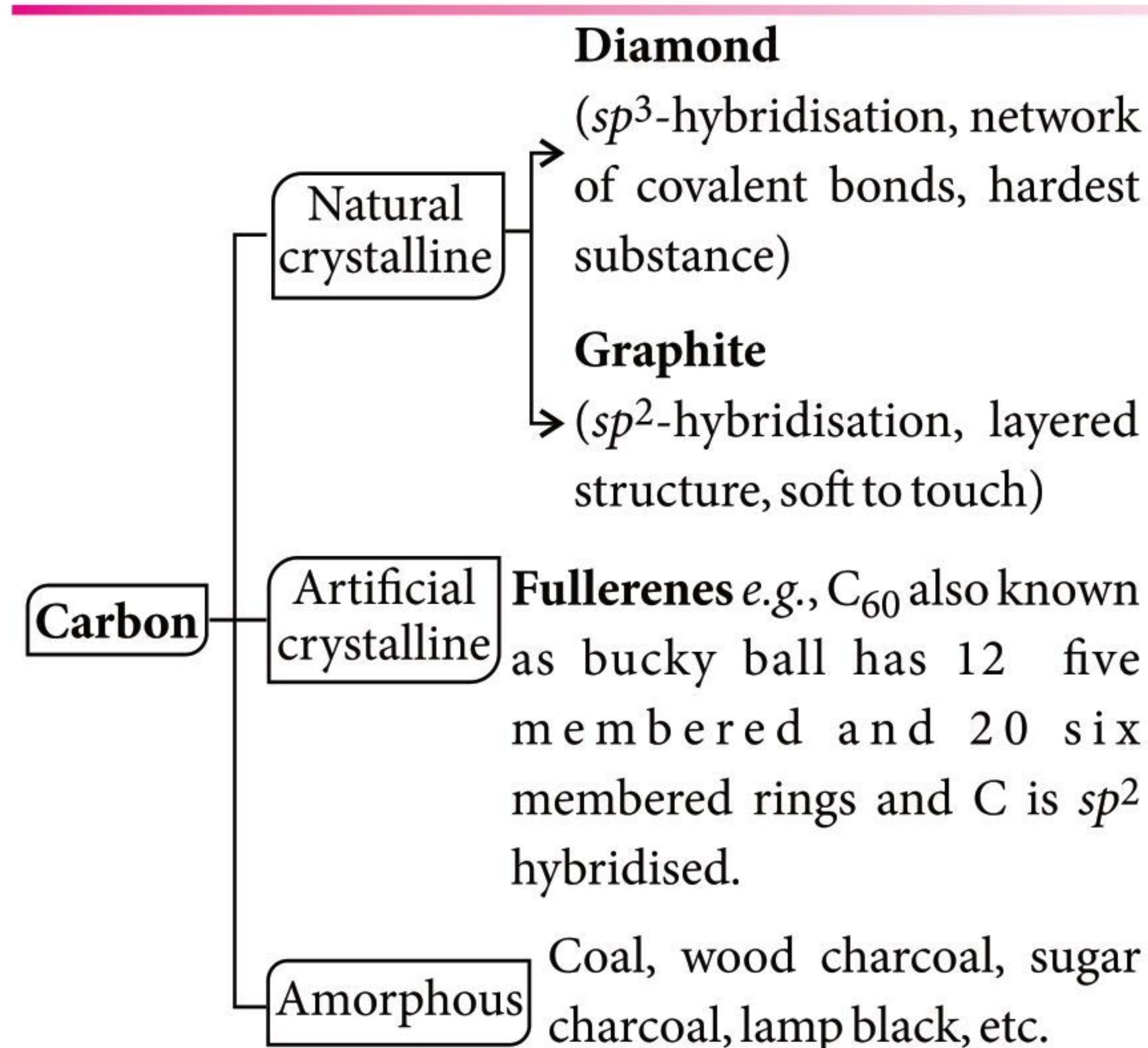
- **Carbides** : The binary compounds of carbon with elements other than hydrogen are called *carbides*.
 - Ionic carbides are formed by the most electropositive metals such as alkali and alkaline earth metals and Al.
 - Both Be_2C and Al_4C_3 are called methanides because they react with H_2O yielding methane.
 - Covalent carbides are formed by Si and B.
 - SiC (carborundum) has a diamond like structure, hence it is called *artificial diamond*.
 - Interstitial carbides are formed by transition elements in which C-atoms occupy interstitial positions in the close-packed arrays of metal atoms. W, Zr, Ti, Ta and Mo can form interstitial carbides.

DISSIMILARITIES BETWEEN CARBON AND SILICON

- Carbon is a black solid that does not melt while silicon is reddish brown solid having melting point 1410°C .
- The dioxide of carbon is gas with linear structure and dioxide of silicon *i.e.*, silica is a solid with three dimensional structure.

- CO is stable while SiO is unstable.
- Carbon does not form complex ions due to absence of *d*-orbitals resulting in maximum covalency of four. Silicon forms complexes and has covalency of six.

ALLOTROPES OF CARBON



ANOMALOUS PROPERTIES OF CARBON

- Carbon differs from other elements of group 14 because of its smaller size, high electronegativity, absence of *d*-orbitals and high tendency of catenation.

Property	Carbon	Other elements
Hardness	hardest (diamond)	less hard
M.pt. and B.pt.	high	low
Maximum covalency	4	6
Multiple bonds	$p\pi-p\pi$ (high extent)	$p\pi-d\pi$ (low extent)
Catenation	very high tendency	very low tendency
Tetrahalides	does not undergo hydrolysis	undergo hydrolysis

Quotable Quote

"One must be sane to think clearly, but one can think deeply and be quite insane."

Nikola Tesla

IMPORTANT COMPOUNDS OF CARBON AND SILICON

Structure

$$\begin{array}{c} \ddot{\text{O}}-\text{C}\equiv\text{O}^+ \longleftrightarrow \\ \text{:}\ddot{\text{O}}=\text{C}=\ddot{\text{O}}\text{:} \\ \updownarrow \\ \text{:}\text{O}\equiv\text{C}-\ddot{\text{O}}^- \end{array}$$

Carbon dioxide
 CO_2

Properties

- It is an acidic oxide and reacts with bases forming salts.
 $\text{CO}_2 + \text{Ca}(\text{OH})_2 \longrightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
 $\text{CO}_2 + \text{K}_2\text{CO}_3 + \text{H}_2\text{O} \longrightarrow 2\text{KHCO}_3$
- It is consumed during photosynthesis.
 $6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow{h\nu} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$

Preparation

- $\text{C}_{(s)} + \text{O}_{2(g)} \xrightarrow{\Delta} \text{CO}_{2(g)}$
- $\text{CH}_{4(g)} + 2\text{O}_{2(g)} \xrightarrow{\Delta} \text{CO}_{2(g)} + 2\text{H}_2\text{O}_{(g)}$
- $\text{CaCO}_{3(s)} + 2\text{HCl}_{(aq)} \longrightarrow \text{CaCl}_{2(aq)} + \text{CO}_{2(g)} + \text{H}_2\text{O}_{(l)}$

Carbon dioxide
 CO_2

Uses

- In aerated water, *e.g.*, in soda water, etc.
- In extinguishing fire.
- Solid CO_2 is called 'dry ice' and is used to freeze foods and ice-cream.
- As carbogen [mixture of $\text{O}_2 + \text{CO}_2$ (5-10%)] in artificial respiration especially for pneumonia patients and victims of CO poisoning.

Structure

$$\text{:C}=\ddot{\text{O}}: \longleftrightarrow \text{:}\overset{+}{\text{C}}\equiv\ddot{\text{O}}\text{:} \text{ or } \text{:C}\equiv\text{O:}$$

Carbon monoxide
 CO

Properties

- Highly poisonous due to the ability to form a complex with haemoglobin (Hb) which is 300 times more stable than O_2 -Hb complex thus, prevents Hb in the RBCs from carrying O_2 around the body.
- It is a powerful reducing agent and reduces many metal oxides to the metal.
- CO molecule acts as a donor and reacts with metals to form metal carbonyls.

Preparation

- $2\text{C}_{(s)} + \text{O}_{2(g)} \xrightarrow{\Delta} 2\text{CO}_{(g)}$
- $\text{HCOOH} \xrightarrow[\text{Conc. H}_2\text{SO}_4]{373 \text{ K}} \text{H}_2\text{O} + \text{CO}$
- $\text{C}_{(s)} + \text{H}_2\text{O}_{(g)} \xrightarrow{473 - 1273 \text{ K}} \underbrace{\text{CO} + \text{H}_2}_{\text{Water gas}}$
- $2\text{C} + \text{O}_2 + 4\text{N}_2 \xrightarrow{473 - 1273 \text{ K}} \underbrace{2\text{CO} + 4\text{N}_2}_{\text{Producer gas}}$

Carbon monoxide
 CO

Uses

- As an important constituent of two industrial fuels, *i.e.*, water gas and producer gas.
- In Mond's process for purification of nickel via nickel carbonyl.

Structure

$$\begin{array}{ccccc} & | & & | & \\ -\text{Si}- & \text{O} & -\text{Si}- & \text{O} & -\text{Si}- \\ & | & & | & \\ -\text{Si}- & \text{O} & -\text{Si}- & \text{O} & -\text{Si}- \\ & | & & | & \\ -\text{Si}- & \text{O} & -\text{Si}- & \text{O} & -\text{Si}- \\ & | & & | & \end{array}$$

Silicon dioxide
 SiO_2

Properties

- Covalent, three dimensional network solid.
- Almost non-reactive due to high Si—O bond enthalpy. However, it is attacked by HF and NaOH.
 $\text{SiO}_2 + 2\text{NaOH} \longrightarrow \text{Na}_2\text{SiO}_3 + \text{H}_2\text{O}$
 $\text{SiO}_2 + 4\text{HF} \longrightarrow \text{SiF}_4 + 2\text{H}_2\text{O}$

Silicon dioxide
 SiO_2

Uses

- Quartz is extensively used as a piezoelectric material.
- It has made possible to develop extremely accurate clocks, modern radio and television broadcasting and mobile radio communications.
- Silica gel is used as a drying agent and as a support for chromatographic materials and catalysts.
- Kieselguhr, an amorphous form of silica is used in filtration plants.

Structure

$$\left(\begin{array}{c} R \\ | \\ R - Si - O - \\ | \\ R \end{array} \right)_n$$

where R = alkyl or phenyl group

Silicones

Properties

- Synthetic organosilicon polymers containing repeated R_2SiO units held by Si–O–Si linkage.
- They are water repelling due to non-polar alkyl groups.

Uses

- They are used as sealant, greases, electrical insulators and for water proofing of fabrics.
- Being biocompatible they are also used in surgical and cosmetic plants.

DIFFERENT TYPES OF SILICATES

- Orthosilicates contain discrete SiO_4^{4-} tetrahedra.
- Pyrosilicates contain $Si_2O_7^{6-}$ anion.
- Cyclic or ring silicates contain $(SiO_3)_n^{2n-}$ anion.
- Chain silicates contain $(SiO_3^{2-})_n$ anions.
- Sheet silicates contain $(Si_2O_5^{2-})_n$ anions.
- Three dimensional silicates have three dimensional network structure.

WRAP it up!

MCQs Type

- Borax is used as a buffer since
 - its aqueous solution contains equal amount of weak acid and its salt
 - it is easily available
 - its aqueous solution contains equal amount of strong acid and its salt
 - none of these.
- Lead pipes are not suitable for drinking water because
 - a layer of lead dioxide is deposited over pipes
 - lead forms basic lead carbonate
 - lead reacts with water and form poisonous lead salts
 - lead reacts with air to form litharge.
- Boric acid is a Lewis acid because its molecule
 - contains replaceable H^+ ion
 - gives up a proton
 - accepts OH^- from water releasing proton
 - combines with proton from water molecule.
- Which of the following acids can be used to dissolve lead (II) oxide?

(a) HNO_3	(b) H_2SO_4
(c) HCl	(d) None of these
- An inorganic salt 'A' is a strong reducing agent. Its hydrolysis in water gives a white turbidity (B). Aqueous solution of 'A' gives a white ppt. (C) with NaOH. 'A' reduces auric chloride to produce purple of cassius. 'A' also reduces iodine and gives chromyl chloride test. Inorganic salt 'A' is

(a) $SnCl_4$	(b) $SnCl_2$
(c) Na_2SnO_2	(d) $Sn(OH)Cl$



COMIC CAPSULE

Don't drink water while studying.
Because chemistry says that



Concentration Decreases on
adding water.

6. The catenation tendency of C, Si and Ge is in the order $\text{Ge} < \text{Si} < \text{C}$. The bond energies (in kJ mol^{-1}) of C—C, Si—Si and Ge—Ge bonds respectively are
 (a) 167, 180, 348 (b) 180, 167, 348
 (c) 348, 167, 180 (d) 348, 180, 167
7. The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence
 (a) $\text{PbX}_2 < \text{SnX}_2 < \text{SiX}_2 < \text{GeX}_2$
 (b) $\text{GeX}_2 < \text{SiX}_2 < \text{PbX}_2 < \text{SnX}_2$
 (c) $\text{SiX}_2 < \text{GeX}_2 < \text{PbX}_2 < \text{SnX}_2$
 (d) $\text{SiX}_2 < \text{GeX}_2 < \text{SnX}_2 < \text{PbX}_2$
8. Which of the following exists in gaseous form in nature?
 (a) ClF_3 (b) BF_3
 (c) IF_3 (d) ICl
9. BF_3 is planar and electron deficient compound. Hybridization and number of electrons around the central atom, respectively are
 (a) sp^2 and 8 (b) sp^3 and 4
 (c) sp^3 and 6 (d) sp^2 and 6
 (NEET 2021)
10. An element of group 14 forms two oxides one of which is highly poisonous and neutral. Other oxide can be easily liquefied and compressed to give a solid which is used as a refrigerant under the name of drikold. The element and the oxides are
 (a) Si, SiO , SiO_2 (b) Pb, PbO , PbO_2
 (c) C, CO , CO_2 (d) Sn, SnO , SnO_2
11. Which of the following statements about group IV elements (C to Pb) is not correct?
 (a) Sn and Pb form dichlorides.
 (b) The thermal stability of hydrides decreases from CH_4 to PbH_4 as bond enthalpy for $M-H$ bond decreases.
 (c) All form tetrafluorides, tetrachlorides.
 (d) All form tetraiodides.
12. In which one of the following molecules strongest back donation of an electron pair from halide to boron is expected?
 (a) BI_3 (b) BBr_3
 (c) BCl_3 (d) BF_3 (JEE Main 2021)
13. Which of the following is strongest bond?
 (a) Si—Si (b) C—C
 (c) Sn—Sn (d) Pb—Pb
14. Iodine oxidises sodium borohydride to give
 (a) B_2H_6 (b) sodium hydride
 (c) HI (d) I_3^-
15. In the aluminothermic process, aluminium acts as
 (a) a flux (b) a solder
 (c) oxidising agent (d) reducing agent.
16. Which is not correct?
 (a) SiO_2 is acidic.
 (b) Ge has higher ionization enthalpy than Sn.
 (c) Ge(OH)_2 is amphoteric.
 (d) GeCl_2 is more stable than GeCl_4 .
17. Covalency of B in BF_4^- is
 (a) 5 (b) 4 (c) 3 (d) 2
18. The structure of diborane (B_2H_6) contains
 (a) four $2c-2e^-$ bonds and two $3c-2e^-$ bonds
 (b) two $2c-2e^-$ bonds and four $3c-2e^-$ bonds
 (c) two $2c-2e^-$ bonds and two $3c-3e^-$ bonds
 (d) four $2c-2e^-$ bonds and four $3c-3e^-$ bonds
19. Alum helps in purifying water by
 (a) forming Si complex with clay particles
 (b) sulphate part which combines with the dirt and removes it
 (c) aluminium which coagulates the mud particles
 (d) making the mud, water soluble.
20. Diborane is a Lewis acid forming addition compound $\text{B}_2\text{H}_6 \cdot 2\text{NH}_3$ with NH_3 , a Lewis base. This
 (a) is ionic and exists as $[\text{BH}_2(\text{NH}_3)_2]^+$ and $[\text{BH}_4]^-$ ions
 (b) on heating, is converted into borazine, $\text{B}_3\text{N}_3\text{H}_6$ (called inorganic benzene)
 (c) both (a) and (b) (d) none is correct.
21. The reaction of $\text{H}_3\text{N}_3\text{B}_3\text{Cl}_3$ (A) with LiBH_4 in tetrahydrofuran gives inorganic benzene (B). Further, the reaction of (A) with (C) leads to $\text{H}_3\text{N}_3\text{B}_3(\text{Me})_3$. Compounds (B) and (C) respectively, are
 (a) diborane and MeMgBr
 (b) borazine and MeBr
 (c) borazine and MeMgBr
 (d) boron nitride and MeBr . (JEE Main 2020)
22. Which of the following statements is not true for both B and Al?
 (a) They burn in oxygen to give oxides at high temperature.
 (b) Their halides are Lewis acids.

- (c) They combine with nitrogen to form nitrides.
(d) They react with HCl to form chlorides.

23. The type of hybridisation of boron in diborane is
(a) sp -hybridisation (b) sp^2 -hybridisation
(c) sp^3 -hybridisation (d) sp^3d^2 -hybridisation.

24. In silicon dioxide

- (a) each silicon atom is surrounded by four oxygen atoms and each oxygen atom is bonded to two silicon atoms
(b) each silicon atom is surrounded by two oxygen atoms and each oxygen atom is bonded to two silicon atoms
(c) silicon atom is bonded to two oxygen atoms
(d) there are double bonds between silicon and oxygen atoms.

25. Correct statements among (A) to (D) regarding silicones are

- (A) they are polymers with hydrophobic character
(B) they are biocompatible
(C) in general, they have high thermal stability and low dielectric strength

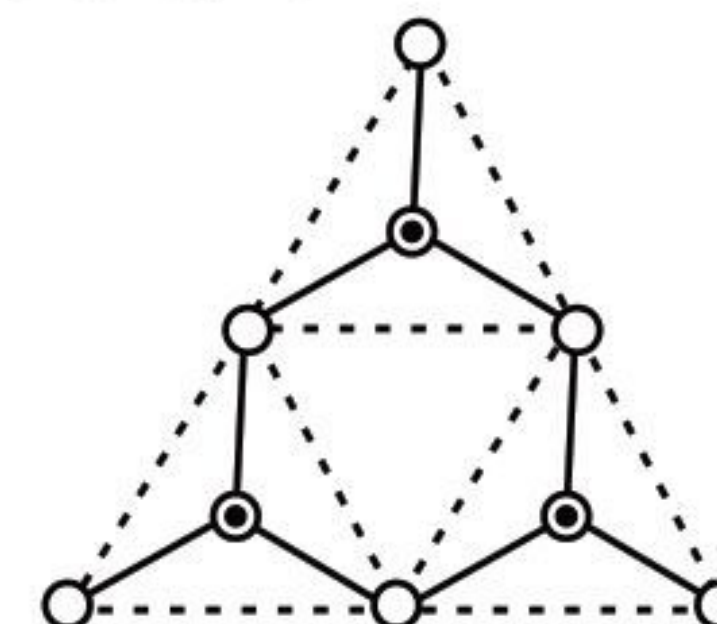
(D) usually, they are resistant to oxidation and used as greases.

- (a) (A), (B), (C) and (D)
(b) (A) and (B) only
(c) (A), (B) and (C) only
(d) (A), (B) and (D) only.

(JEE Main 2019)

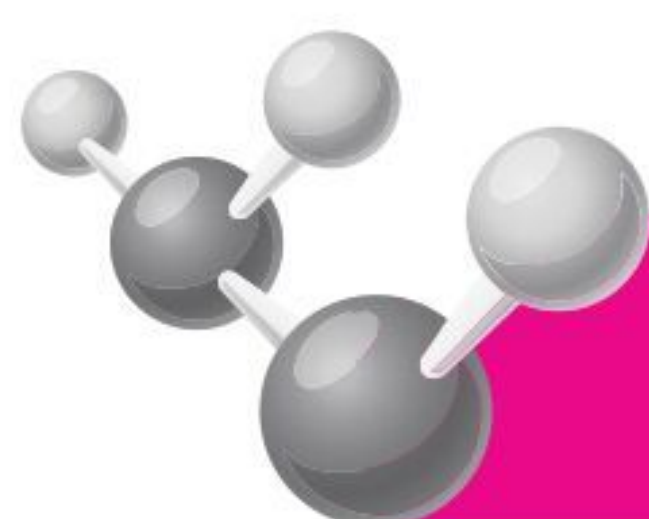
NUMERICAL VALUE TYPE

26. The following structure is a silicate having formula $\text{Si}_3\text{O}_9^{x-}$. The value of x is

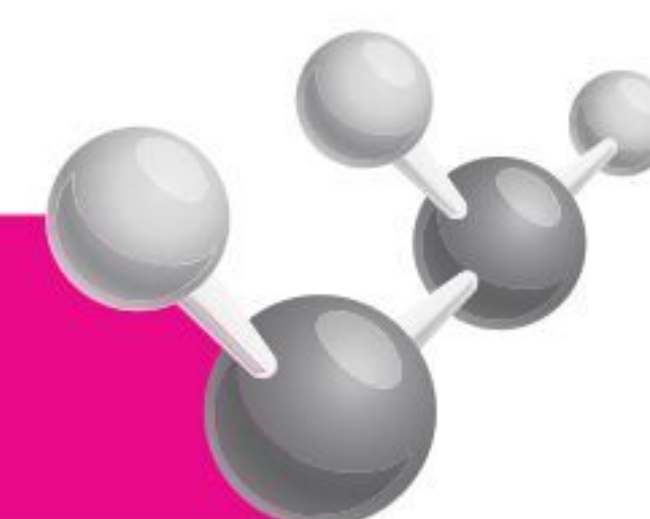


27. Three moles of B_2H_6 are completely reacted with methanol. The number of moles of boron containing product formed is _____.

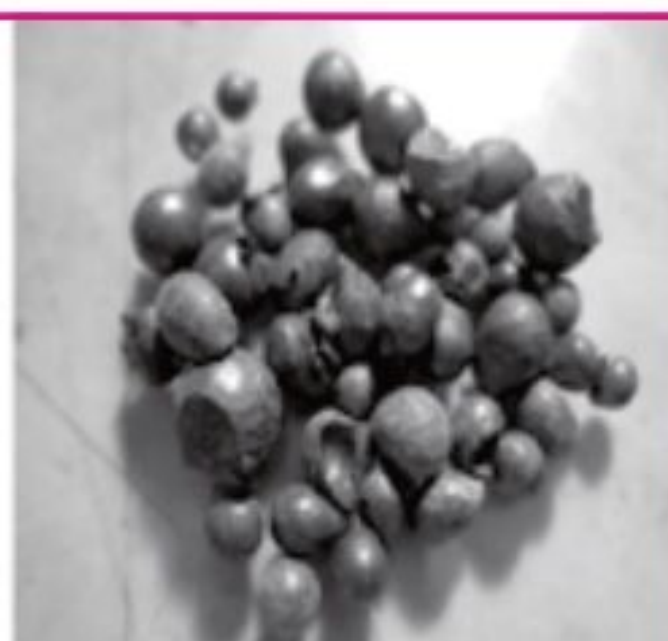
28. Diborane reacts with ammonia to form an adduct which on heating at 473 K decomposes to give a volatile compound called borazine. The number of π -bonds in borazine is _____.



3 Amazing Facts You Must Know



Turn
lead



into
gold



1. You can Turn Lead into Gold!!

Yes, you can turn lead into gold but not by chemical means, and the physical process is totally not worth it. The difference between the two metals is the atomic number, defined by the number of protons they have in their nuclei. You can go from lead (it has 82 protons) to gold (it has 79 protons) by removing 3 protons from the nucleus. This can be straightforwardly achieved using particle accelerators. In fact, this is the way new elements are discovered, by using magnetic and electrical fields to accelerate particles, which then impacts a starting nucleus. This impact can remove protons or neutrons from the nucleus, giving rise to new elements, or isotopes, respectively.



2. Why Is Water Blue?

As some suggest, water is not blue due to the reflection of the sky. Water is blue on its own. Any object shows a given color because it is absorbing visible light from some other wavelength preferentially. Water has a weak absorption band in the red part of the visible spectra (close to the infrared zone). For this reason, water shows a blue color. Since this red absorption band is so weak, we can only observe the blue color if we have a massive volume of water. That is why water in a glass appears to be colorless, but bigger volumes such as oceans, lakes, or swimming pools, are blue.



3. One can Die for Drinking too Much Water!

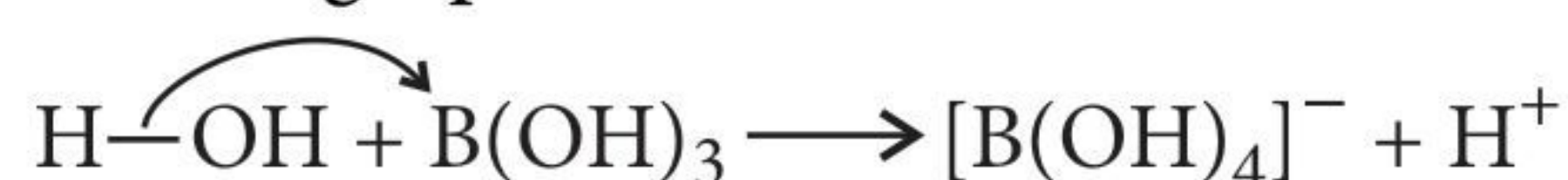
Hyponatremia (which means "low in sodium") is what water intoxication is called. Approximately, drinking 6 liters of water in a relatively short time, can cause serious injuries, even death! This happens because huge amount of water make your blood concentration of sodium (or other electrolytes) drops drastically, making your cells accumulate too much water inside, swell, and even rupture.

This would happen more easily if you drank distilled water.

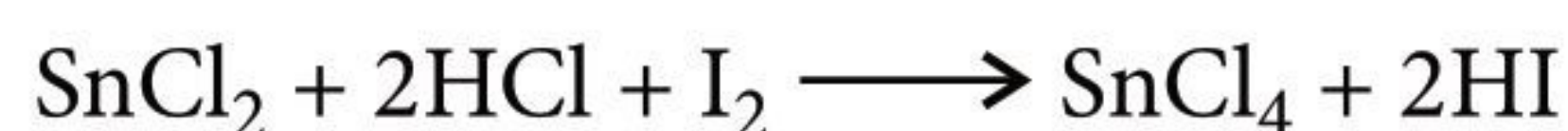
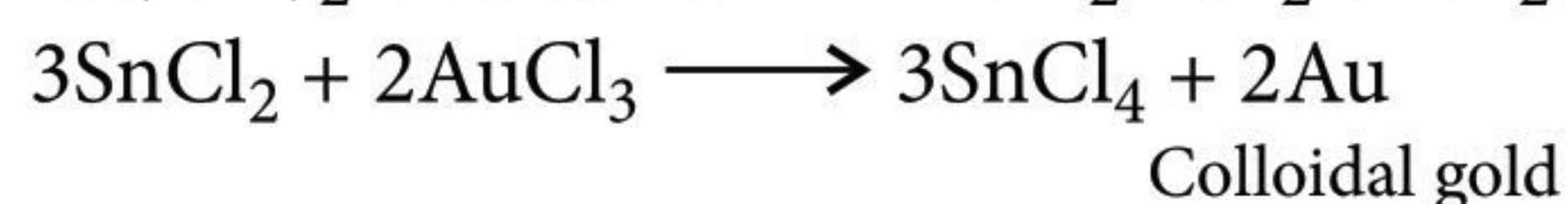
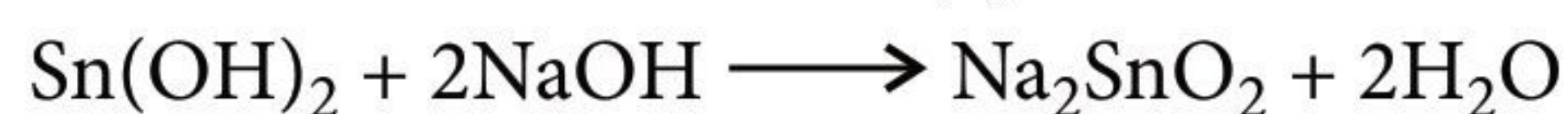
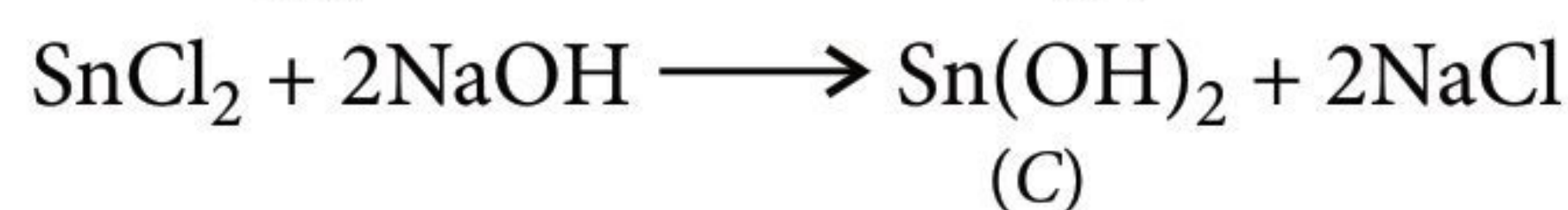
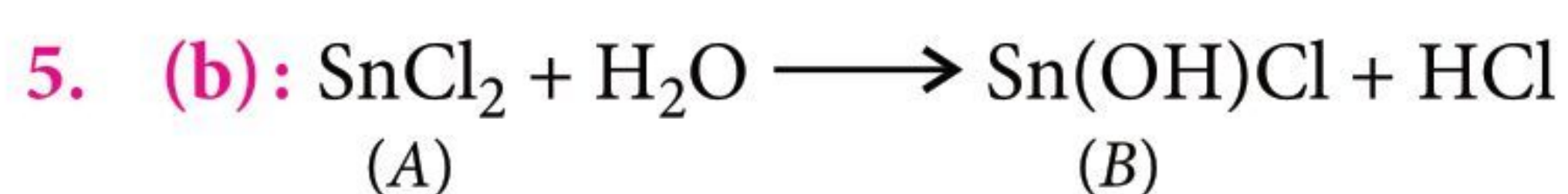
29. In BF_3 , what is the bond order of B-F bond?
30. Amongst the following, the maximum number of compounds showing covalent nature is _____.
 BCl_3 , BBr_3 , AlF_3 , AlCl_3 , AlBr_3 , $\text{Al}(\text{NO}_3)_3$, $\text{Al}_2(\text{SO}_4)_3$

SOLUTIONS

1. (a): Borax is used as a buffer as it contains weak acid and its salt with strong base.
 $\text{Na}_2\text{B}_4\text{O}_7 + 7\text{H}_2\text{O} \longrightarrow 2\text{Na}[\text{B}(\text{OH})_4] + 2\text{H}_3\text{BO}_3$
2. (c): Lead reacts with water to form lead salts which are poisonous. Hence, lead pipes are not suitable for drinking purpose.
3. (c): Boric acid behaves as a Lewis acid, by accepting a pair of electrons from OH^- ion of water thereby releasing a proton.



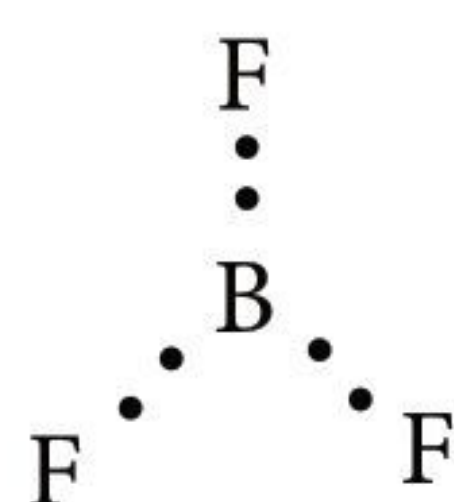
4. (a): Nitric acid can be used to dissolve PbO . This is because lead nitrate formed is soluble in water. If H_2SO_4 is used, an insoluble layer of PbSO_4 is deposited on the surface of powder and prevents the further reaction. Likewise, PbCl_2 prevents the reaction with HCl .



6. (d): Higher the bond energies of element-element bond, more is the catenation tendency.
7. (d): The stability of dihalides increases in the sequence: $\text{SiX}_2 < \text{GeX}_2 < \text{SnX}_2 < \text{PbX}_2$. Due to inert pair effect the stability of +2 oxidation state increases down the group.

8. (b)

9. (d): BF_3 is a sp^2 -hybridised planar molecule. It forms 3σ -bonds with 3F-atoms hence has six electrons around it.



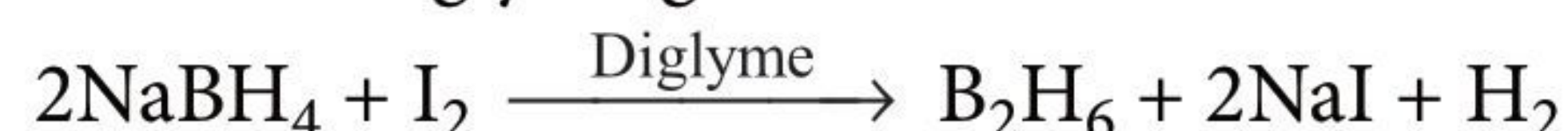
10. (c): C forms two oxides CO and CO_2 . CO is neutral and poisonous. CO_2 can be compressed to a refrigerant dry ice or solid CO_2 . SiO is unstable. SnO and PbO are amphoteric in nature.

11. (d): All elements of group 14 do not form triiodide. PbI_4 does not exist because Pb^{4+} ion is strong oxidising agent and I^- ion is strong reducing agent. Thus, Pb^{4+} cannot exist in presence of I^- ion and get reduced to Pb^{2+} ion.

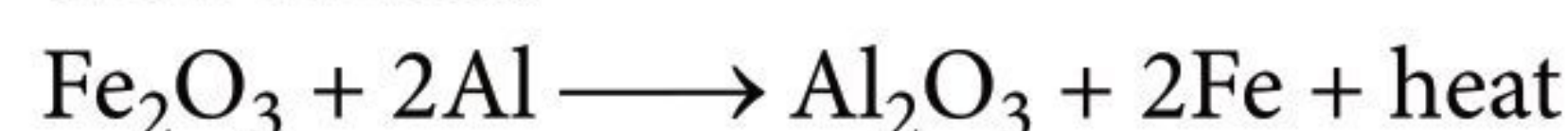
12. (d): Boron has an empty p -orbital while fluorine has a lone pair of electrons in its p -orbital. As a result boron acts as a Lewis acid and F acts as a Lewis base. Then, fluorine transfers two electrons to vacant $2p$ -orbital of boron, thus forming $p\pi-p\pi$ bond. This type of bond has some double bond character and is known as dative or back bonding.

13. (b): Bond strength of $M-M$ bond decreases in the order $\text{C}-\text{C} > \text{Si}-\text{Si} > \text{Ge}-\text{Ge} > \text{Sn}-\text{Sn}$. Greater the bond energy, greater is the strength of bond.

14. (a): The oxidation of sodium borohydride with iodine in diglyme gives diborane.



15. (d): In aluminothermic process aluminium is used as a reducing agent for obtaining other metals from their oxides.

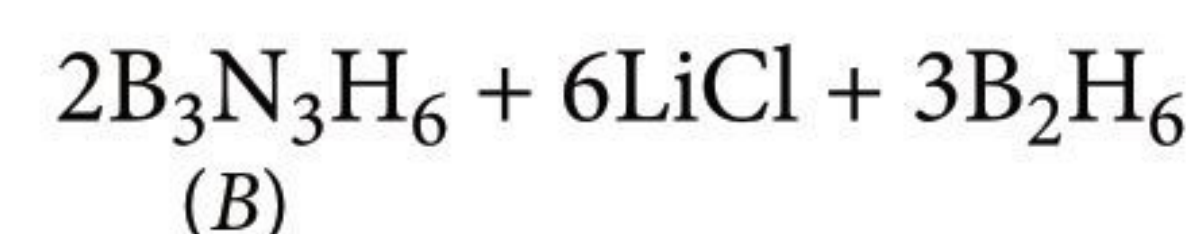
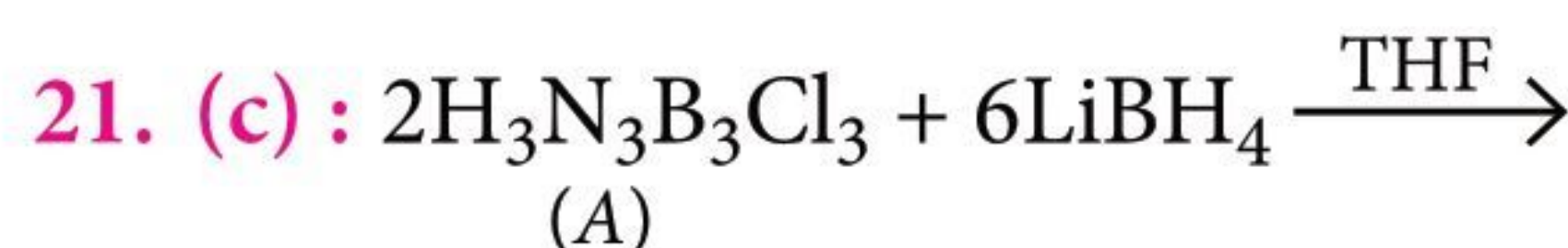
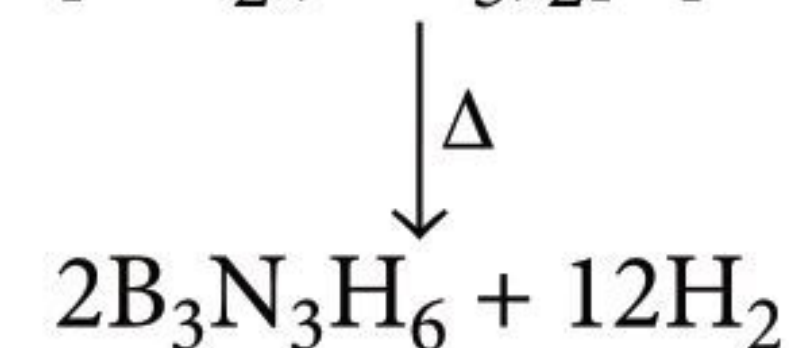


16. (d): Ge has greater tendency to show +4 oxidation state.

17. (b): Covalency of B in BF_4^- is 4 which is its maximum covalency also.

18. (a): The four terminal B-H bonds are normal $2c-2e$ bonds, the two bridge bonds are $3c-2e^-$ bonds.

19. (c)

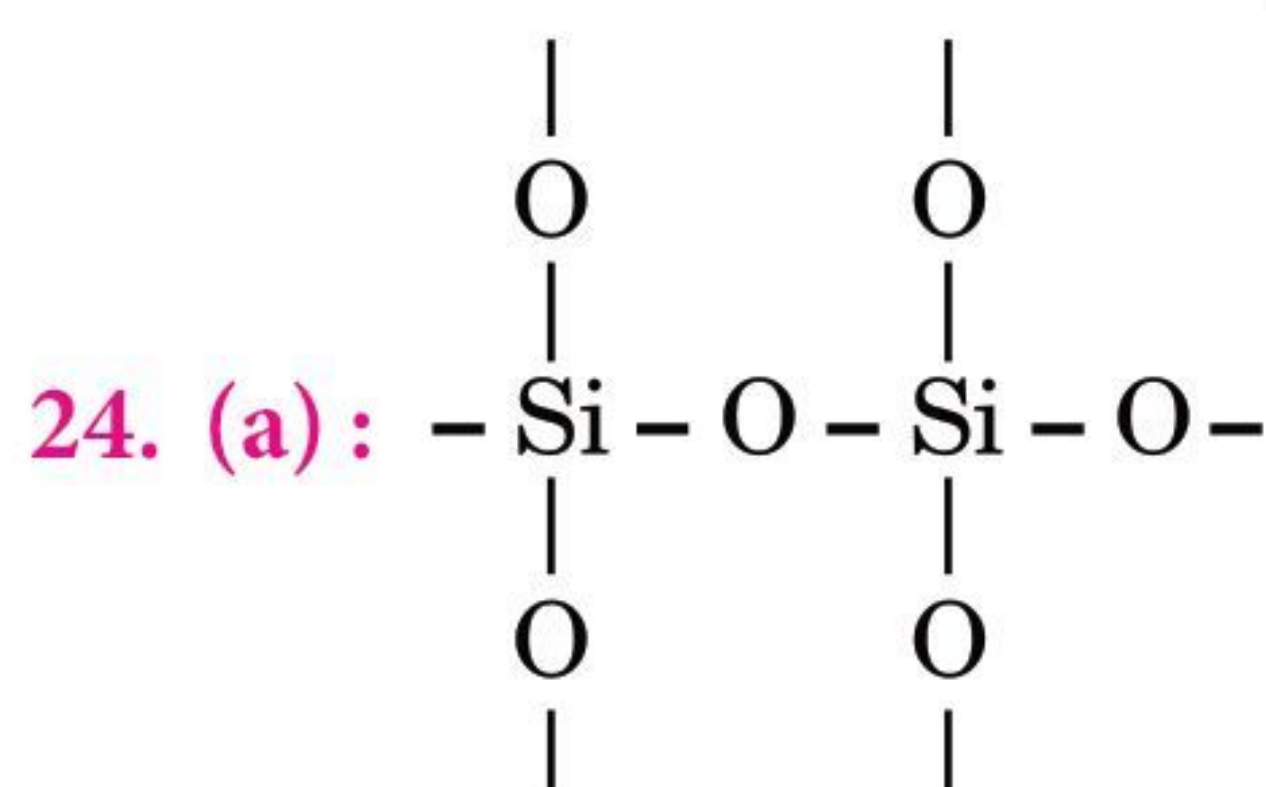
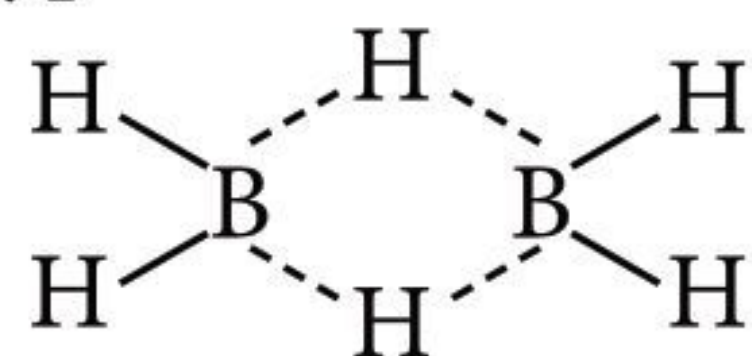


Borazine ($\text{B}_3\text{N}_3\text{H}_6$) is also called inorganic benzene.

22. (d): Boron being non-metal does not displace hydrogen from HCl to produce its chloride.

23. (c): Each 'B' atom in diborane (B_2H_6) is sp^3 -hybridised. Of the 4 hybrid orbitals, three have one electron each, while the 4th is empty.

Two orbitals of each B form σ bonds with two 'H' atoms, while one of the remaining hybrid orbital (either filled or empty), 1s orbital of 'H' atom and one of the hybrid orbitals of other 'B' atom overlap to form three centred two electron bond. So there exists two such type of $3c-2e^-$ bonds.

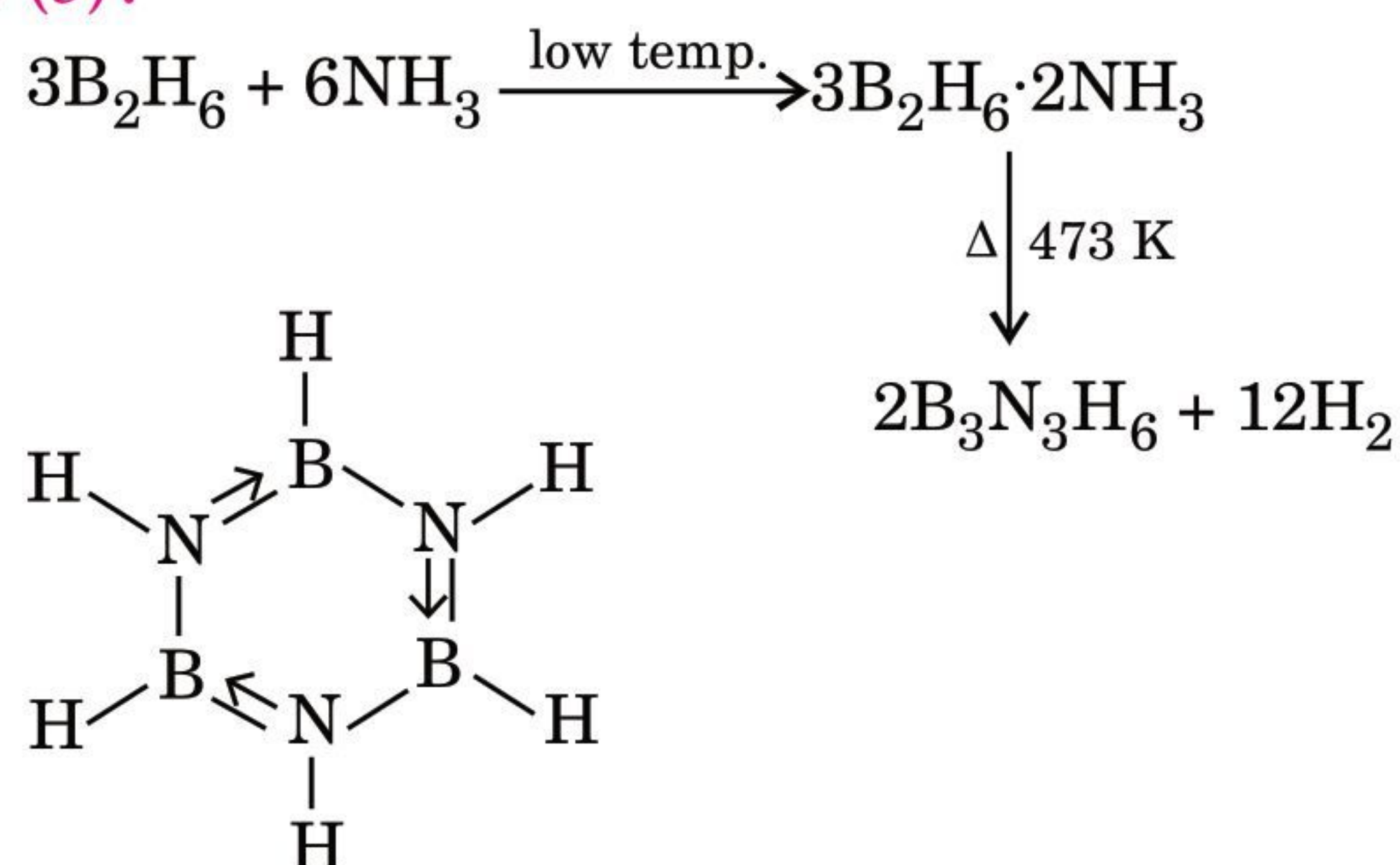


25. (d): In general they have high thermal stability, high dielectric strength and resistance to oxidation and chemicals.

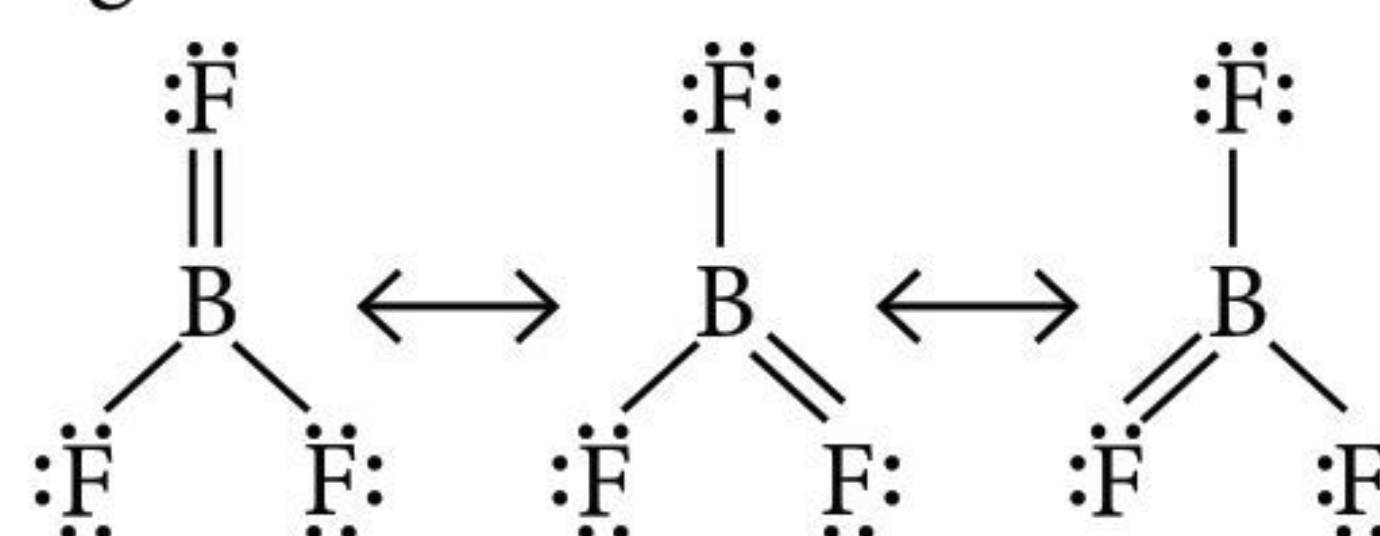
26. (6)

27. (6): $[\text{B}_2\text{H}_6 + 6\text{CH}_3\text{OH} \longrightarrow 2\text{B}(\text{OCH}_3)_3 + 6\text{H}_2] \times 3$
 $3\text{B}_2\text{H}_6 + 18\text{CH}_3\text{OH} \longrightarrow 6\text{B}(\text{OCH}_3)_3 + 18\text{H}_2$
 Thus, no. of moles of boron containing product formed by reacting 3 moles of B_2H_6 completely with methanol is 6.

28. (3):



29. (1.33): BF_3 is a resonance hybrid of these structures each having one double bond and two single bond.



Hence, bond order of B-F

$$= 1 + \frac{1}{3} = \frac{4}{3} = 1.33$$

30. (4): BCl_3 , BBr_3 , AlCl_3 and AlBr_3 are covalent compounds.

Buy digital copies
of your favorite
magazine



Visit Now : digital.mtg.in

Study Anytime ! Anywhere !



mtg



CBSE

warm-up!

CLASS-XI

TERM-I OBJECTIVE TYPE QUESTIONS

Practice Paper 2021

Time allowed : 90 minutes
Maximum marks : 35

GENERAL INSTRUCTIONS

1. The Question Paper contains three sections.
2. Section A has 25 questions. Attempt any 20 questions.
3. Section B has 24 questions. Attempt any 20 questions.
4. Section C has 6 questions. Attempt any 5 questions.
5. All questions carry equal marks.
6. There is no negative marking.

Mark your answer in the Sample OMR Sheet given after Practice Paper to get familiar with the actual paper pattern.

- Some Basic Concepts of Chemistry
- Structure of Atom
- Classification of Elements and Periodicity in Properties
- Chemical Bonding and Molecular Structure
- Redox Reactions
- Hydrogen
- Organic Chemistry : Some Basic Principles and Techniques

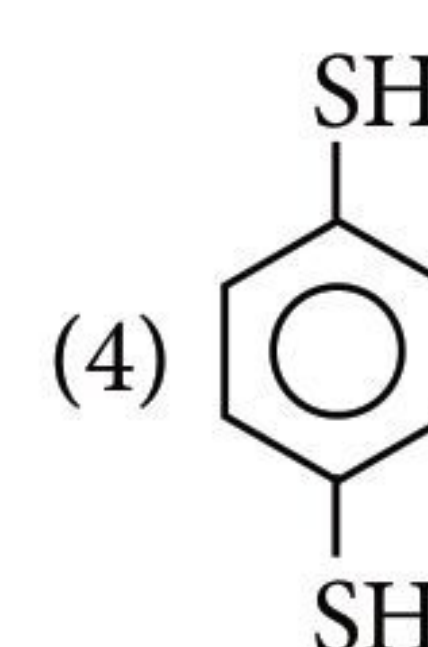
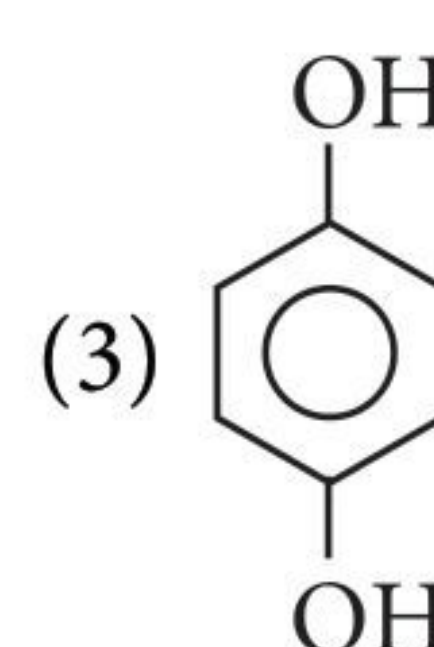
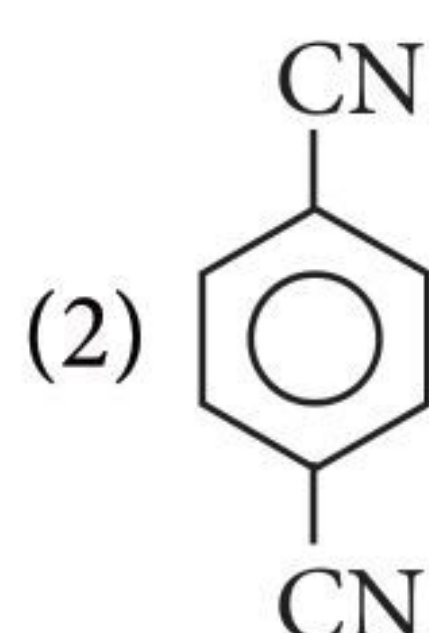
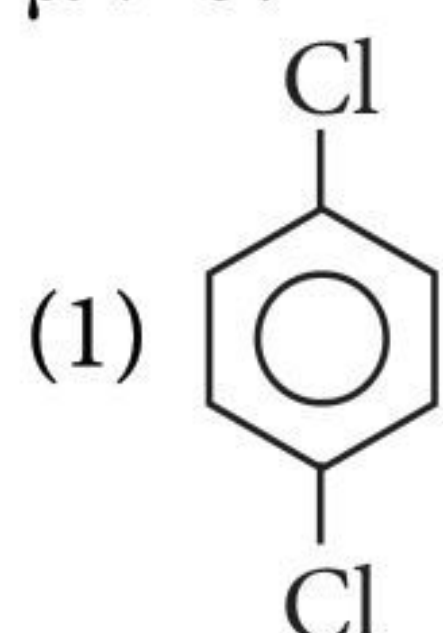
SECTION - A

This section consists of 25 multiple choice questions with overall choice to attempt any 20 questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.

1. If n and l are the principal and azimuthal quantum numbers, then the expression for calculating the total number of electrons at an energy level can accommodate is

- (a) $\sum_{l=1}^{l=n} 2(2l+1)$ (b) $\sum_{l=1}^{l=n-1} 2(2l+1)$
(c) $\sum_{l=0}^{l=n+1} 2(2l+1)$ (d) $\sum_{l=0}^{l=n-1} 2(2l+1)$

2. For which of the following molecules significant $\mu \neq 0$?



- (a) (3) and (4) (b) Only (1)
(c) (1) and (2) (d) Only (3)

3. In which of the following options the order of arrangement does not agree with the variation of property indicated against it?

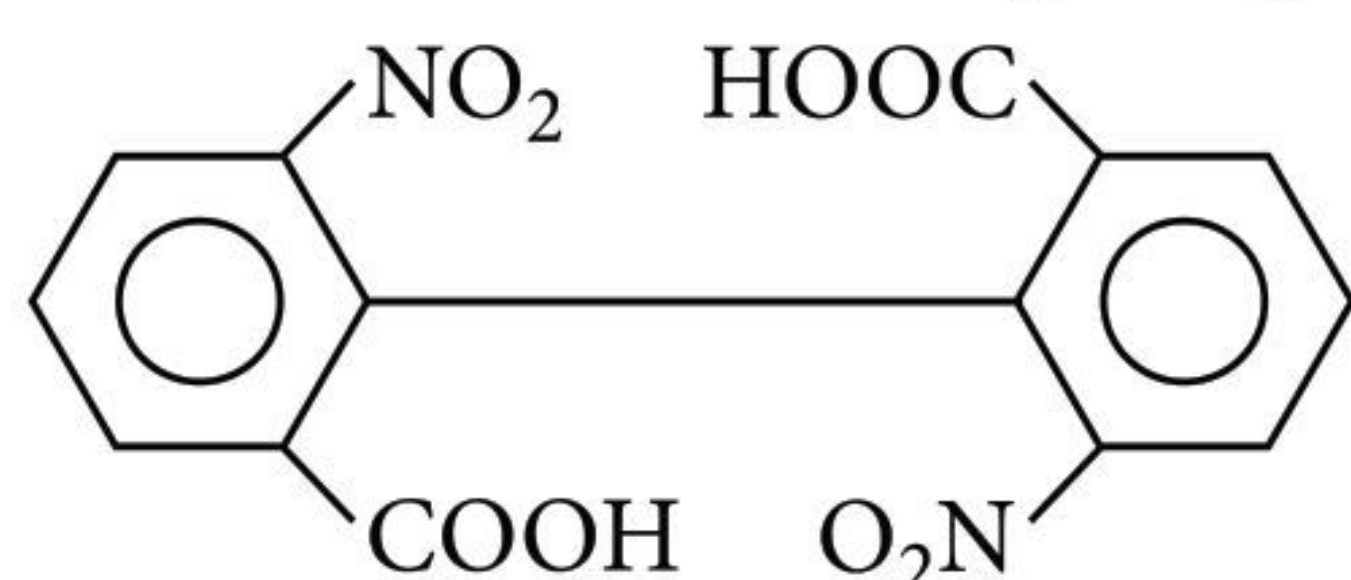
- (a) $I < Br < F < Cl$ (increasing negative electron gain enthalpy)
(b) $Li < Na < K < Rb$ (increasing metallic radius)
(c) $Al^{3+} < Mg^{2+} < Na^+ < F^-$ (increasing ionic size)
(d) $B < C < N < O$ (increasing first ionisation enthalpy)

4. According to molecular orbital theory which of the following statements about the magnetic character and bond order is correct regarding O_2^+ ?

- (a) Paramagnetic and bond order $< O_2$
(b) Paramagnetic and bond order $> O_2$

- (c) Diamagnetic and bond order $< O_2$
 (d) Diamagnetic and bond order $> O_2$

5. The IUPAC name of the following compound is



- (a) 2, 2'-dinitrodiphenic acid
 (b) 6, 6'-dinitrodiphenic acid
 (c) 6, 6'-dinitrophenyl-2, 2'-dicarboxylic acid
 (d) 2, 2'-dinitrophenyl-6, 6'-dicarboxylic acid.
6. Two particles A and B are in motion. If the wavelength associated with the particle A is 5×10^{-8} m, calculate the wavelength of particle B if its momentum is half of A.
 (a) 10^{-8} m (b) 10^{-6} m
 (c) 10^{-5} m (d) 10^{-7} m
7. Element with atomic number 115 has electronic configuration as and with most stable cation as
 (a) $[Rn]5f^{14}6d^{10}7s^27p^3$; M^{3+}
 (b) $[Rn]7s^25d^{10}4f^{14}7p^3$; M^{5+}
 (c) $[Rn] 7s^25d^{10}4f^{14}7p^3$; M^+
 (d) $[Rn] 5d^{10}4f^{14}7p^5$; M^{5+}
8. Which of the following is more appropriate representation for the resonance hybrid of nitrate ion?
 (a) $O \equiv \overset{+}{N} \begin{matrix} \nearrow O^- \\ \searrow O^- \end{matrix}$ (b) $^{-2/3} O \equiv \overset{+}{N} \begin{matrix} \nearrow O^{-2/3} \\ \searrow O^{-2/3} \end{matrix}$
 (c) $\left[O \equiv \overset{+}{N} \begin{matrix} \nearrow O \\ \searrow O \end{matrix} \right]^-$ (d) $\left[O - \overset{+}{N} \begin{matrix} \nearrow O \\ \searrow O \end{matrix} \right]^{2-}$
9. Among CaH_2 , NH_3 , NaH and B_2H_6 , which are covalent hydrides?
 (a) NH_3 and B_2H_6 (b) NaH and CaH_2
 (c) NaH and NH_3 (d) CaH_2 and B_2H_6
10. Vitamin C (ascorbic acid) contains 40.92% C, 4.58% H and 54.50% of O by mass. If molecular weight of ascorbic acid is 176 g mol^{-1} , what is the molecular formula?
 (a) $C_3H_2O_3$ (b) C_4H_3O
 (c) $C_6H_8O_6$ (d) $C_3H_4O_3$

11. Mass percentage of deuterium in heavy water is
 (a) same as that of protium in water
 (b) 11.1
 (c) 20.0
 (d) cannot be predicted.

12. When BrO_3^- ion reacts with Br^- ion in acidic medium, Br_2 is liberated. The equivalent mass of Br_2 in the reactions is

- (a) $\frac{5M}{3}$ (b) $\frac{3M}{5}$
 (c) $\frac{4M}{6}$ (d) $\frac{5M}{8}$

13. $\frac{N_A}{2}$ atoms of $X_{(g)}$ are converted into $X_{(g)}^+$ by energy E_1 . $\frac{N_A}{2}$ atoms of $X_{(g)}$ are converted into $X_{(g)}^-$ by energy E_2 . Hence, ionisation potential and electron affinity of $X_{(g)}$ are respectively

- (a) $\frac{2E_1}{N_A}, \frac{2(E_1 - E_2)}{N_A}$ (b) $\frac{2E_1}{N_A}, \frac{2E_2}{N_A}$
 (c) $\frac{(E_1 - E_2)}{N_A}, \frac{2E_2}{N_A}$ (d) none is correct.

14. Most efficient overlapping is

- (a) sp^2-sp^2 overlap (b) $s-s$ overlap
 (c) sp^3-sp^3 overlap (d) $sp-sp$ overlap.

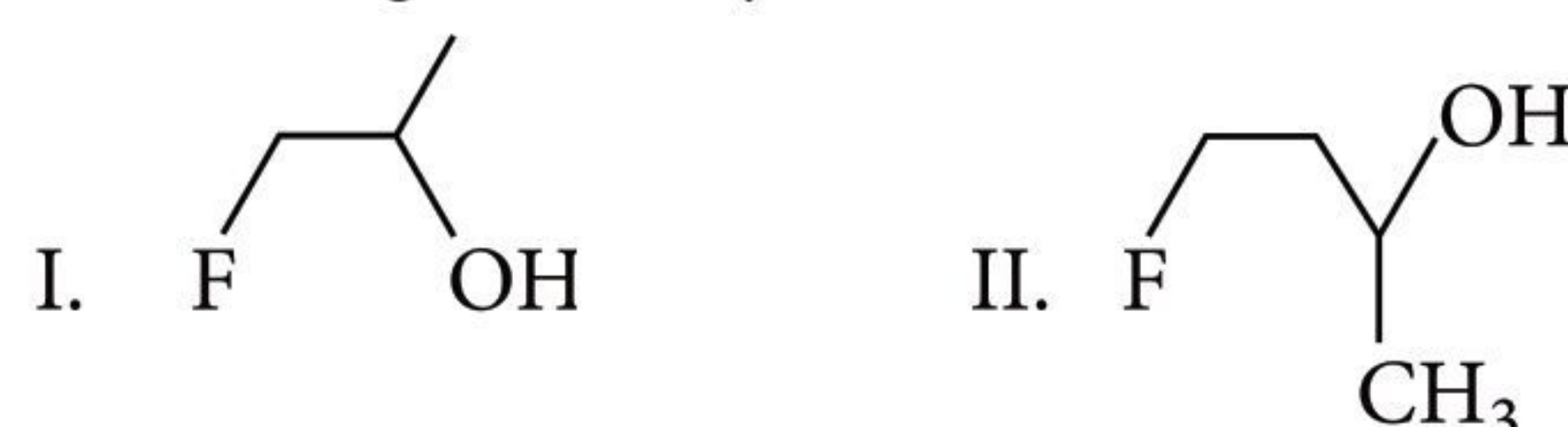
15. Which of the following represents the correct order of increasing first ionization enthalpy for Ca, Ba, S, Se and Ar?

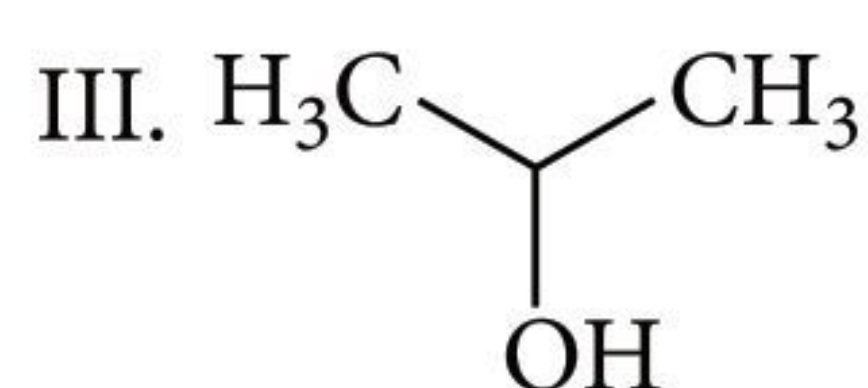
- (a) $Ca < Ba < S < Se < Ar$
 (b) $Ca < S < Ba < Se < Ar$
 (c) $S < Se < Ca < Ba < Ar$
 (d) $Ba < Ca < Se < S < Ar$

16. Splitting of spectral lines under the influence of magnetic field is called

- (a) Stark effect
 (b) Zeeman effect
 (c) photoelectric effect
 (d) screening effect.

17. Arrange the following alcohols in order of their decreasing tendency to form carbocation.





- (a) I > II > III > IV (b) IV > III > I > II
(c) IV > III > II > I (d) II > I > IV > III

18. When hard water is passed through permutit, which ions are exchanged with Ca^{2+} and Mg^{2+} ?
(a) Na^+ (b) Al^{3+}
(c) H^+ (d) All of these
19. Which of the following is an electrophilic reagent?
(a) H_2O (b) NH_3
(c) OH^- (d) NO_2^+
20. In the following disproportionation of Cl_2 in basic medium
 $\text{Cl}_2 + 2\text{KOH} \longrightarrow \text{KCl} + \text{KClO} + \text{H}_2\text{O}$
equivalent mass of Cl_2 is
(a) 35.50 (b) 71.00
(c) 47.33 (d) 11.83
21. On heating, 100 g of $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ will lose _____ % of water.
(a) 44.1 (b) 65.3
(c) 17.4 (d) 34.7
22. The correct sequence of the oxidation state of underlined elements is
 $\text{Na}\underline{\text{B}}\text{H}_4$, $\text{K}_2\underline{\text{Ta}}\text{F}_7$, $\text{Mg}_2\underline{\text{P}}_2\text{O}_7$, $\text{Na}_2\underline{\text{S}}_4\text{O}_6$, $\underline{\text{N}}_3\text{H}$
(a) +3, +5, +5, +2.5, $-\frac{1}{3}$
(b) +5, +3, +5, +3, $+\frac{1}{3}$
(c) +3, +3, +5, +5, $-\frac{1}{3}$
(d) +5, +5, +3, +2.5, $+\frac{1}{3}$
23. Ethanol-water mixture has 46% ethanol (weight/solution weight). Hence, mole fraction of H_2O is
(a) 0.46 (b) 0.54
(c) 0.25 (d) 0.75
24. In the disproportionation reaction,
 $3\text{HClO}_3 \longrightarrow \text{HClO}_4 + \text{Cl}_2 + 2\text{O}_2 + \text{H}_2\text{O}$, the equivalent mass of the oxidizing agent is (Molar mass of $\text{HClO}_3 = 84.45 \text{ g mol}^{-1}$)
(a) 16.89 (b) 32.22
(c) 84.45 (d) 28.15
25. A mixture of HCOOH and $\text{H}_2\text{C}_2\text{O}_4$ is heated with concentrated H_2SO_4 . The gas produced is collected and on treating with KOH solution, the volume

of gas decreases by one-sixth. The molar ratio of the two acids ($\text{HCOOH} : \text{H}_2\text{C}_2\text{O}_4$) in the original mixture is

- (a) 5 (b) 4 (c) 2 (d) 3

SECTION - B

This section consists of 24 multiple choice questions with overall choice to attempt any 20 questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.

26. When a certain metal was irradiated with light of frequency $3.2 \times 10^{16} \text{ Hz}$, photoelectrons emitted



Extremely Efficient New Method for Removing Heavy-Metal Contaminants From Drinking Water!!

Engineers have designed a relatively low-cost, energy-efficient approach for treating water contaminated with heavy metals.

Engineers at MIT have developed a new approach for removing lead or other heavy-metal contaminants from water, in a process that they say is far more energy-efficient than any other currently used system, though there are other under developments that come close. Ultimately, it might be used to treat lead-contaminated water supplies at the home level, or to treat contaminated water from some chemical or industrial processes.

The new system is the latest in the series of applications based on initial findings six years ago by members of the same research team, initially developed for desalination of seawater or brackish water, and later adapted for removing radioactive compounds from the cooling water of nuclear power plants. The new version is the first such method that might be applicable for treating household water supplies, as well as industrial uses.

The biggest challenge in trying to remove lead is that it is generally present in such tiny concentrations, vastly exceeded by other elements or compounds. For example, sodium is typically present in drinking water at a concentration of tens of parts per million, whereas lead can be highly toxic at just a few parts per billion. Most existing processes, such as reverse osmosis or distillation, remove everything at once. Scientist explains that it not only takes much more energy than would be needed for a selective removal, but it's counterproductive since small amounts of elements such as sodium and magnesium are actually essential for healthy drinking water.

The new approach uses a process called shock electrodialysis, in which an electric field is used to produce a shockwave inside an electrically charged porous material carrying the contaminated water. The shock wave propagates from one side to the other as the voltage increases, leaving behind a zone where the metal ions are depleted, and separating the feed stream into a brine and a fresh stream. The process results in a 95 percent reduction of lead from the outgoing fresh stream.

had twice the kinetic energy as did photoelectrons emitted when the same metal was irradiated with light of frequency 2.0×10^{16} Hz. Hence, threshold frequency is

- (a) 0.8×10^{15} Hz (b) 8.0×10^{15} Hz
(c) 0.85×10^{14} Hz (d) 6.4×10^{16} Hz

27. If the climbing of water droplets is made to occur on a coated microscope slide, the slide would have to be coated in which of the following way?

- (a)

POLAR

 (b)

NON POLAR

(c)

POLAR
↑
NON POLAR

 (d)

NON POLAR
↑
POLAR

28. Carbon suboxide (C_3O_2) has been shown as a component of the atmosphere of Venus. Which of the following formulation represents the correct ground state Lewis structure for carbon suboxide?

- (a) $:O:C::C:C:O:$ (b) $:O::C::C::C:O:$
(c) $:\ddot{O}::C::C::C::\ddot{O}:$ (d) $:\ddot{O}:C:C:C:\ddot{O}:$

29. Which of the following statements is not true?

- (a) Ordinary water is electrolysed more rapidly than D_2O .
(b) Reaction between H_2 and Cl_2 is much faster than D_2 and Cl_2 .
(c) D_2O freezes at lower temperature than H_2O .
(d) Bond dissociation energy for D_2 is greater than H_2 .

30. Which of the following represents the correct order of Cl—O bond lengths in ClO^- , ClO_2^- , ClO_3^- , ClO_4^- ?

- (a) $ClO_4^- = ClO_3^- = ClO_2^- = ClO^-$
(b) $ClO^- < ClO_2^- < ClO_3^- < ClO_4^-$
(c) $ClO_4^- < ClO_3^- < ClO_2^- < ClO^-$
(d) $ClO_3^- < ClO_4^- < ClO_2^- < ClO^-$

31. The increasing order of stability of the following free radicals is

- (a) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C}$
(b) $(C_6H_5)_3\dot{C} < (C_6H_5)_2\dot{C}H < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$
(c) $(C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C} < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$
(d) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_3\dot{C} < (C_6H_5)_2\dot{C}H$

32. The limiting line in Balmer series will have a frequency of

- (a) $6.22 \times 10^{15} s^{-1}$ (b) $7.22 \times 10^{14} s^{-1}$
(c) $8.22 \times 10^{14} s^{-1}$ (d) $9.22 \times 10^{14} s^{-1}$

33. An element A in a compound ABD has oxidation number A^{n-} . It is oxidised by $Cr_2O_7^{2-}$ in acidic medium. In the experiment 1.68×10^{-3} mole of $K_2Cr_2O_7$ were used for 3.26×10^{-3} mole of ABD. The new oxidation number of A after oxidation is

- (a) 3 (b) $3 - n$
(c) $n - 3$ (d) $+ n$

34. For an element, I.E. values are

$(I.E.)_1 = 738 \text{ kJ mol}^{-1}$, $(I.E.)_2 = 1450 \text{ kJ mol}^{-1}$
 $(I.E.)_3 = 7.7 \times 10^3 \text{ kJ mol}^{-1}$ and $(I.E.)_4 = 1.1 \times 10^4 \text{ kJ mol}^{-1}$.

This element belongs to

- (a) alkali metals (b) alkaline earth metals
(c) chalcogens (d) halogens.

35. Which one of the following will have largest number of atoms?

- (a) 1 g $Au_{(s)}$ (b) 1 g $Na_{(s)}$
(c) 1 g $Li_{(s)}$ (d) 1 g $Cl_{2(g)}$

36. Calculate the number of millilitres at STP of H_2S gas needed to precipitate cupric sulphide completely from 100 mL of a solution containing 0.75 g of $CuCl_2$ in 1 L.

- (a) 21.4 (b) 14.2 (c) 41.2 (d) 125

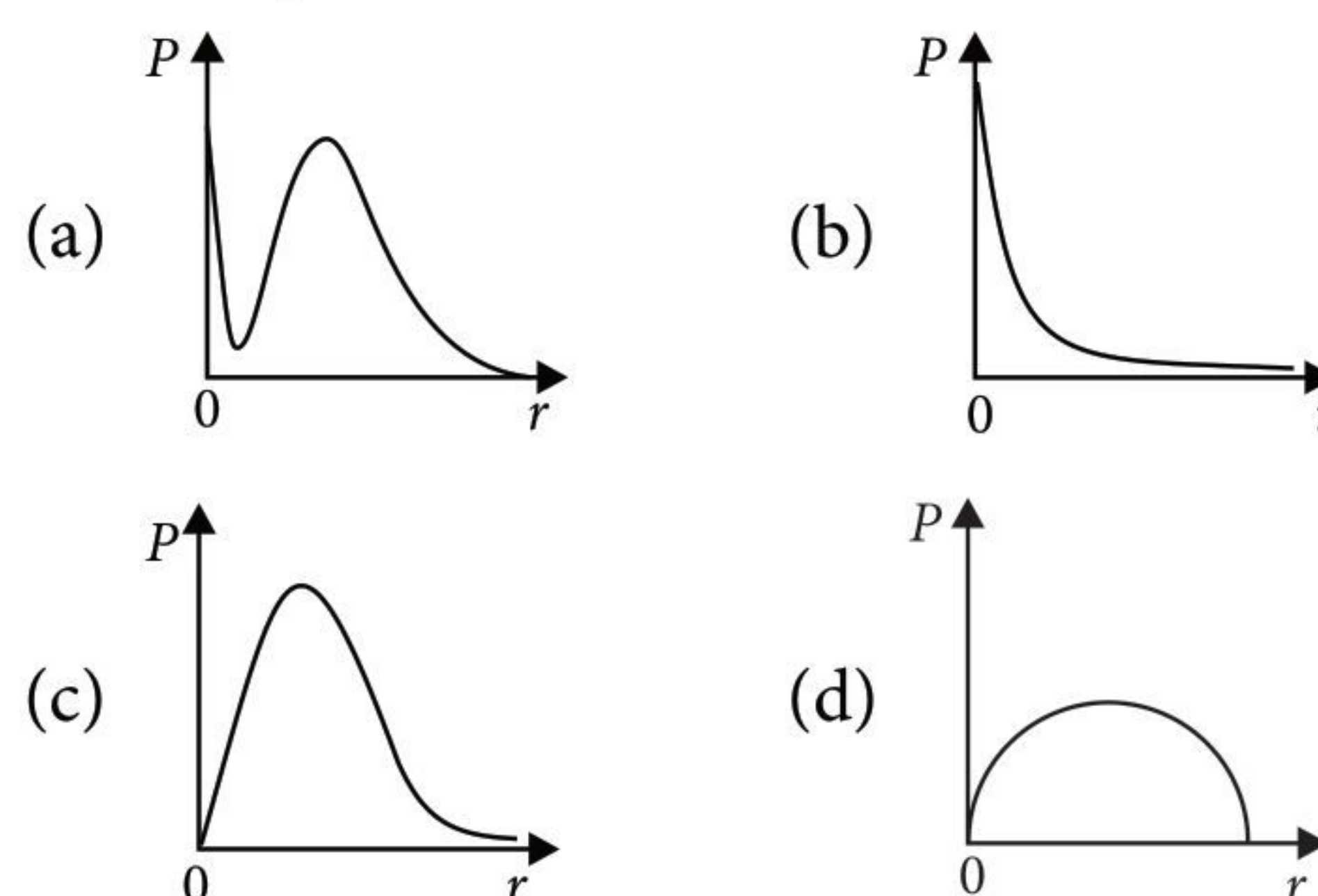
37. Chlorine in vinyl chloride is less reactive because

- (a) sp^2 -hybridised carbon has more acidic character than sp^3 -hybridised carbon
(b) C—Cl bond develops partial double bond character because of resonance
(c) C—Cl bond is weak
(d) both (b) and (c).

38. Which of the following compounds is used for water softening?

- (a) $Ca_3(PO_4)_2$ (b) Na_3PO_4
(c) $Na_6P_6O_{18}$ (d) Na_2HPO_4

39. P is the probability of finding the 1s electron of hydrogen atom in a spherical shell of infinitesimal thickness dr , at a distance r from the nucleus. The volume of this shell is $4\pi r^2 dr$. The qualitative sketch of the dependence of P on r is



40. The oxidation states of sulphur in Caro's and Marshall's acid are

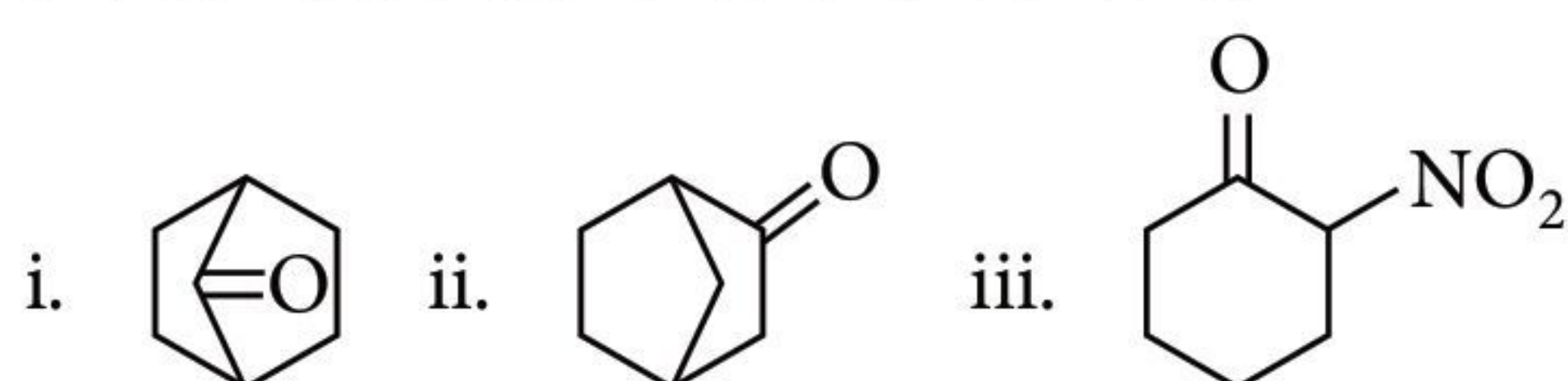
- (a) +6, +6 (b) +4, +6
(c) +6, -6 (d) +6, +4

41. The electronic configuration of four elements are given below. Arrange these elements in the correct order of the magnitude (without sign) of their electron affinity.

- (i) $2s^2 2p^5$ (ii) $3s^2 3p^5$
(iii) $2s^2 2p^4$ (iv) $3s^2 3p^4$

- (a) (ii) < (i) < (iv) < (iii)
(b) (i) < (iii) < (iv) < (ii)
(c) (i) < (ii) < (iv) < (iii)
(d) (iii) < (iv) < (i) < (ii)

42. Among these compounds, which of the following is the correct order of % enol content?



- (a) i > ii > iii (b) iii > ii > i
(c) ii > iii > i (d) i > iii > ii

43. Number of σ and π bonds in benzophenone is

- (a) 24, 6 (b) 25, 6
(c) 25, 7 (d) 24, 7

44. A compound of Xe and F is found to have 53.5% Xe. What is the oxidation number of Xe in this compound?

- (a) -4 (b) 0
(c) +4 (d) +6

45. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion : 1 mole of water is equal to 6.023×10^{23} molecules.

Reason : The mass of one mole of a substance in grams is called the molar mass.

Select the most appropriate answer from the options given below.

- (a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

46. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion : The energy of the electron in hydrogen atom has a negative sign for all possible orbits.

Reason : When the electron is attracted by the nucleus and is present in orbit n , the energy is emitted and its energy is lowered.

Select the most appropriate answer from the options given below.

- (a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

47. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion : Each H_2O molecule is linked to four H_2O molecules tetrahedrally.

Reason : Each H_2O molecule is linked to two H_2O molecules through covalent bonds and to two H_2O molecules through hydrogen bonds.

Select the most appropriate answer from the options given below.

- (a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

48. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion : Demineralised water does not contain any ions.

Reason : Permutit process for water softening gives demineralised water.

Select the most appropriate answer from the options given below.

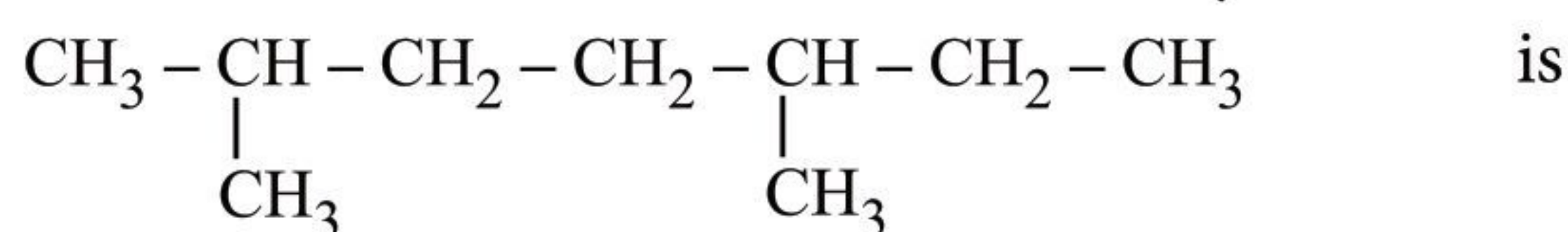
- (a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

MONTHLY TEST DRIVE CLASS XII ANSWER KEY

- | | | | | |
|------------|---------------|---------------|---------|------------|
| 1. (b) | 2. (b) | 3. (a) | 4. (b) | 5. (b) |
| 6. (b) | 7. (c) | 8. (b) | 9. (c) | 10. (b) |
| 11. (d) | 12. (b) | 13. (c) | 14. (a) | 15. (c) |
| 16. (b) | 17. (b) | 18. (c) | 19. (b) | 20. (a, b) |
| 21. (a, b) | 22. (a, c, d) | 23. (b, c, d) | 24. (4) | 25. (3) |
| 26. (4) | 27. (a) | 28. (d) | 29. (a) | 30. (a) |

49. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion : The name of the hydrocarbon



is 2,5-dimethylheptane and not 3,6-dimethylheptane.

Reason : Numbering should be done in such a way that sum of the locants on the parent chain is lowest possible number. (2 + 5 = 7) is lower than (3 + 6 = 9).

Select the most appropriate answer from the options given below.

- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is not the correct explanation of A.
- A is true but R is false.
- A is false but R is true.

SECTION - C

This section consists of 6 multiple choice questions with an overall choice to attempt any 5. In case more than desirable number of questions are attempted, ONLY first 5 will be considered for evaluation.

50. The values of IE_1 and IE_2 (kJ mol^{-1}) of few elements are given in List I. Match their characteristics given in List II.

List I		List II	
P.	IE_1 2372, IE_2 5251	1.	A reactive metal
Q.	IE_1 520, IE_2 7300	2.	A reactive non-metal
R.	IE_1 900, IE_2 1760	3.	A noble gas
S.	IE_1 1680, IE_2 3380	4.	A metal that forms an halide of formula AX_2

	P	Q	R	S
(a)	3	4	2	1
(b)	3	1	4	2
(c)	1	2	3	4
(d)	4	3	2	1

51. Which of the following is not a correct analogy?

(a) Bohr orbital energy: $E_n = \frac{-13.6 Z^2}{n^2} \text{ eV/atom} ::$

Bohr orbital radius: $0.529 n^2/Z \text{ \AA}$

(b) Lyman series: $n_1 = 1 ; n_2 = 2, 3, 4, \dots ::$

Balmer series: $n_1 = 2 ; n_2 = 3, 4, 5, \dots$

(c) Magnetic quantum number: $-l$ to $+l ::$

Azimuthal quantum number: 0 to $n - 1$

(d) s -Subshell; Maximum number of electrons = $2 ::$

p -Subshell; Maximum number of electrons = 8

52. Complete the following analogy.

$A : \text{XeOF}_4 :: B : \text{IF}_2^-$

(a) $A : sp^3d :: B : sp^3d^2$ (b) $A : sp^3d :: B : sp^3$

(c) $A : sp^3d^2 :: B : sp^3d$ (d) $A : sp^3 :: B : sp^3d$

Read the passage given below and answer the following questions 53-55.

- Inductive effect involves displacement of σ electrons along a saturated carbon chain when an electron donating (+I effect) or electron withdrawing (−I effect) group is attached at the end of the carbon chain.
- Electromeric effect involves complete transfer of π electrons of a multiple bond towards one of the bonded atoms in the presence of an attacking reagent.
- +E effect when electron transfer takes place towards the atom to which the attacking reagent gets attached.
- −E effect when electron transfer takes place away from the atom to which the attacking reagent gets attached.
- Mesomeric effect is defined as the polarity produced in the molecule by the interaction of two π bonds or between a π bond and a lone pair of electrons present on adjacent atom.

53. The dipole moment of vinyl chloride is lower than that of ethyl chloride. This is due to

- resonance effect
- inductive effect
- electromeric effect
- hyperconjugation effect.

54. Arrange the carbanions, $(\text{CH}_3)_3\bar{\text{C}}$, $\bar{\text{CCl}}_3$, $(\text{CH}_3)_2\bar{\text{CH}}$, $\text{C}_6\text{H}_5\bar{\text{CH}}_2$, in order of their decreasing stability.

- $\text{C}_6\text{H}_5\bar{\text{CH}}_2 > \bar{\text{CCl}}_3 > (\text{CH}_3)_3\bar{\text{C}} > (\text{CH}_3)_2\bar{\text{CH}}$
- $(\text{CH}_3)_2\bar{\text{CH}} > \bar{\text{CCl}}_3 > \text{C}_6\text{H}_5\bar{\text{CH}}_2 > (\text{CH}_3)_3\bar{\text{C}}$
- $\bar{\text{CCl}}_3 > \text{C}_6\text{H}_5\bar{\text{CH}}_2 > (\text{CH}_3)_2\bar{\text{CH}} > (\text{CH}_3)_3\bar{\text{C}}$
- $(\text{CH}_3)_3\bar{\text{C}} > (\text{CH}_3)_2\bar{\text{CH}} > \text{C}_6\text{H}_5\bar{\text{CH}}_2 > \bar{\text{CCl}}_3$

55. The hyperconjugative stabilities of *tert*-butyl cation and 2-butene, respectively, are due to

- $\sigma \rightarrow p$ (empty) and $\sigma \rightarrow \pi^*$ electron delocalisations
- $\sigma \rightarrow \sigma^*$ and $\sigma \rightarrow \pi$ electron delocalisations
- $\sigma \rightarrow p$ (filled) and $\sigma \rightarrow \pi$ electron delocalisations
- p (filled) $\rightarrow \sigma^*$ and $\sigma \rightarrow \pi^*$ electron delocalisations.

SAMPLE OMR SHEET

General Instructions

- Details of the candidates will be pre-filled in the OMR.
- Candidate has to write a Question Paper Code in the upper right corner in the space provided for the same. Question Paper Code will be written on the Question Paper.
- Candidate has to write in his/her own hand in the space provided "I confirm that all particulars given above are correct" and sign in the running hand on OMR.
- Only Blue/Black ball point pen is to be used for filling desired information and for giving responses.
- Use of pencil is strictly prohibited.

Important features of the OMR:

- There is a space for answering 60 questions in an OMR irrespective of total questions given in the Question Papers of any subject.
- Answers given after the maximum question number in your question paper will not be evaluated.

उत्तर पत्रिका / ANSWER SHEET

केवल नीले/काले बॉल प्वाइंट पेन का ही प्रयोग करें।
USE ONLY BLUE/BLACK BALL POINT PEN

अनुक्रमांक Roll No.	
(अंकों में एवं शब्दों में) (in digits and words)	
परीक्षा का दिन एवं तिथि Day & Date of the Examination	
केन्द्र संख्या व नाम Center No. & Name	
विषय कोड व नाम Subject code & Name	043 & Chemistry
अभ्यर्थी का नाम Candidate's Name	
पिता का नाम Father's Name	
विद्यालय का कोड व नाम School code and Name	

अधीक्षक की मोहर / Facsimile stamp of the Center Supdt.
--

उच्च माध्यमिक विद्यालय परीक्षा (कक्षा ग्यारहवीं) Senior Secondary School Examination (Class XI)

	OMR No.
प्रश्न पत्र के ऊपर लिखे कोड को दर्शाएँ Write code No. written on the question paper Question Paper Code <div style="display: flex; justify-content: center; gap: 5px;"> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div>	
SOME EXAMPLES OF WRONG/CORRECT WAYS OF MARKING AS FOLLOWS	
WRONG METHOD	CORRECT METHOD
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8

प्रत्येक प्रश्न का उत्तर केवल एक ही गोले में गहरा निशान लगाकर दीजिए एवं उत्तर को बॉक्स में लिखें Darken **ONLY ONE CIRCLE** for each Question and write the answer in the box.

Q.No.	Response	*	#
1	(a) (b) (c) (d)		①
2	(a) (b) (c) (d)		②
3	(a) (b) (c) (d)		③
4	(a) (b) (c) (d)		④
5	(a) (b) (c) (d)		⑤
6	(a) (b) (c) (d)		⑥
7	(a) (b) (c) (d)		⑦
8	(a) (b) (c) (d)		⑧
9	(a) (b) (c) (d)		⑨
10	(a) (b) (c) (d)		⑩
11	(a) (b) (c) (d)		⑪
12	(a) (b) (c) (d)		⑫
13	(a) (b) (c) (d)		⑬
14	(a) (b) (c) (d)		⑭
15	(a) (b) (c) (d)		⑮

* Write Correct Option

Darken Circle if question not attempted

Q.No.	Response	*	#
16	(a) (b) (c) (d)		⑯
17	(a) (b) (c) (d)		⑰
18	(a) (b) (c) (d)		⑱
19	(a) (b) (c) (d)		⑲
20	(a) (b) (c) (d)		⑳
21	(a) (b) (c) (d)		㉑
22	(a) (b) (c) (d)		㉒
23	(a) (b) (c) (d)		㉓
24	(a) (b) (c) (d)		㉔
25	(a) (b) (c) (d)		㉕
26	(a) (b) (c) (d)		㉖
27	(a) (b) (c) (d)		㉗
28	(a) (b) (c) (d)		㉘
29	(a) (b) (c) (d)		㉙
30	(a) (b) (c) (d)		㉚

Q.No.	Response	*	#
31	(a) (b) (c) (d)		㉛
32	(a) (b) (c) (d)		㉜
33	(a) (b) (c) (d)		㉝
34	(a) (b) (c) (d)		㉞
35	(a) (b) (c) (d)		㉟
36	(a) (b) (c) (d)		㊱
37	(a) (b) (c) (d)		㊲
38	(a) (b) (c) (d)		㊳
39	(a) (b) (c) (d)		㊴
40	(a) (b) (c) (d)		㊵
41	(a) (b) (c) (d)		㊶
42	(a) (b) (c) (d)		㊷
43	(a) (b) (c) (d)		㊸
44	(a) (b) (c) (d)		㊹
45	(a) (b) (c) (d)		㊺

Q.No.	Response	*	#
46	(a) (b) (c) (d)		㊻
47	(a) (b) (c) (d)		㊼
48	(a) (b) (c) (d)		㊽
49	(a) (b) (c) (d)		㊾
50	(a) (b) (c) (d)		㊿
51	(a) (b) (c) (d)		①
52	(a) (b) (c) (d)		②
53	(a) (b) (c) (d)		③
54	(a) (b) (c) (d)		④
55	(a) (b) (c) (d)		⑤
56	(a) (b) (c) (d)		⑥
57	(a) (b) (c) (d)		⑦
58	(a) (b) (c) (d)		⑧
59	(a) (b) (c) (d)		⑨
60	(a) (b) (c) (d)		⑩

I confirm that all particulars given above are correct.		अभ्यर्थी के हस्ताक्षर (चलते हाथ से लिखें) Candidate's Signature (in running hand)
---	--	--

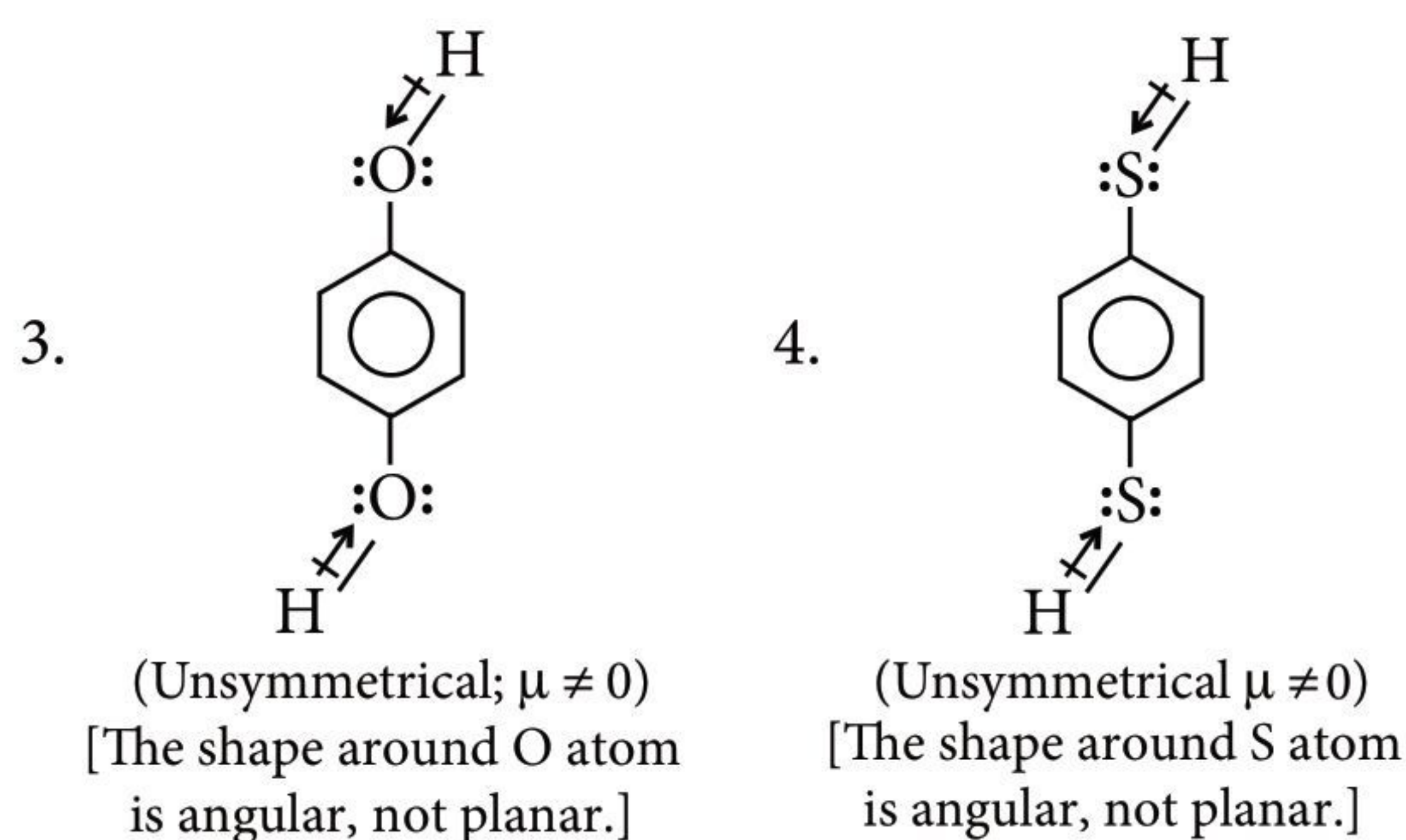
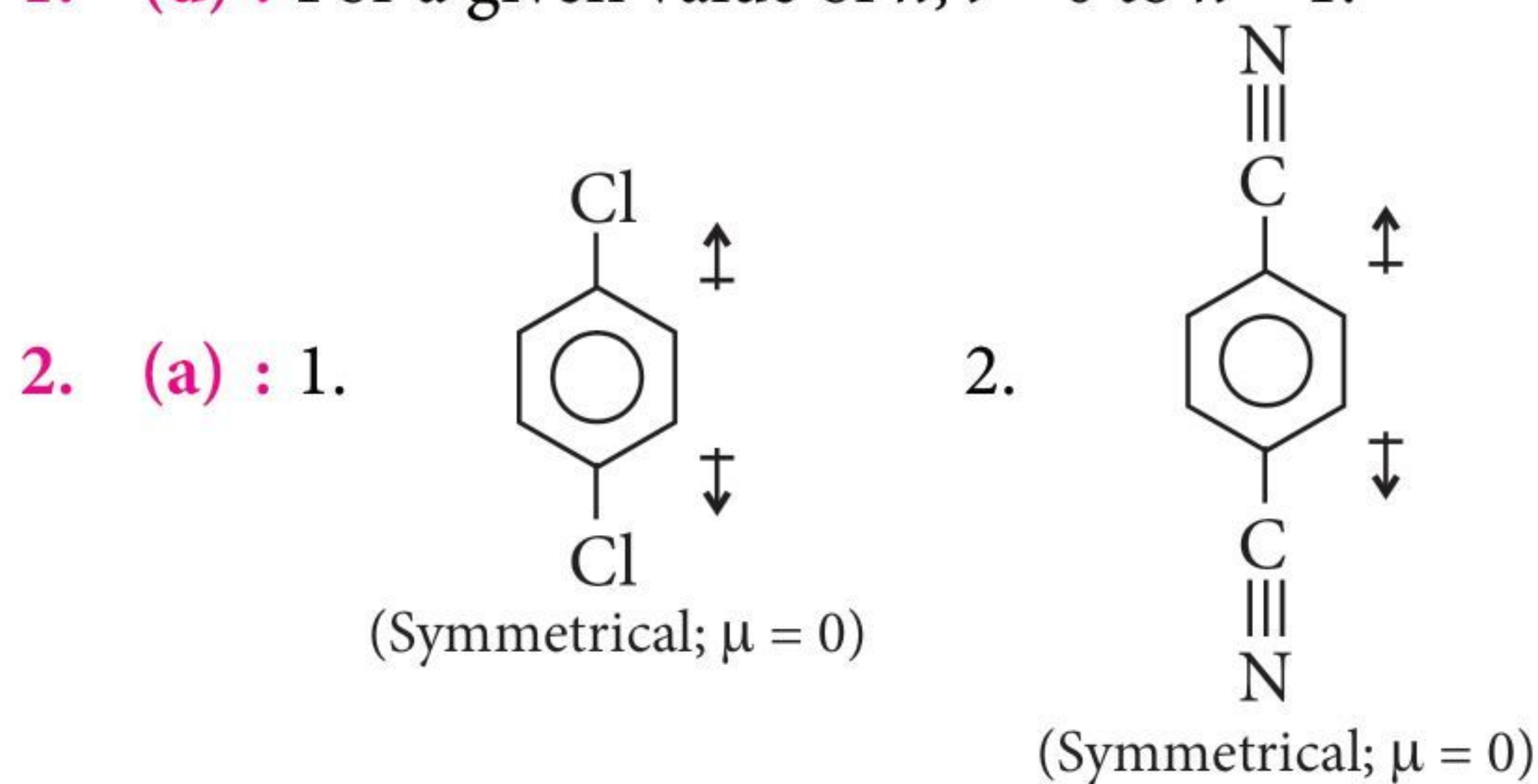
Total correct answers (To be filled by the Evaluator)	<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>
--	---

Total correct answers (To be filled by the Coordinator)	<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>
--	---

For more details visit cbse.gov.in

SOLUTIONS

1. (d) : For a given value of n , $l = 0$ to $n - 1$.

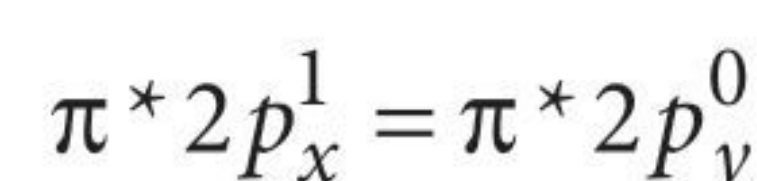
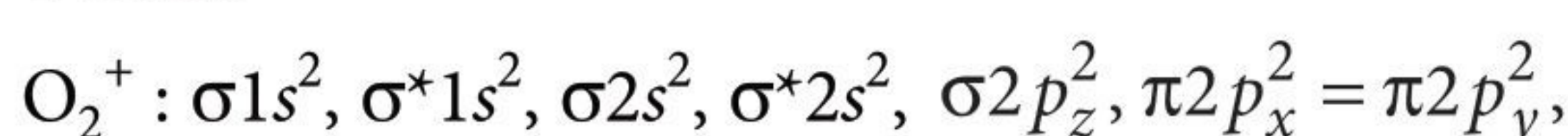


3. (d) : The correct order of increasing first ionisation enthalpy is $B < C < O < N$ due to half filled orbital of nitrogen which provides extra stability to valence electrons of nitrogen.

4. (b) : O_2 : $\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \pi 2p_x^2 = \pi 2p_y^2, \pi 2p_x^{*1} = \pi 2p_y^{*1}$

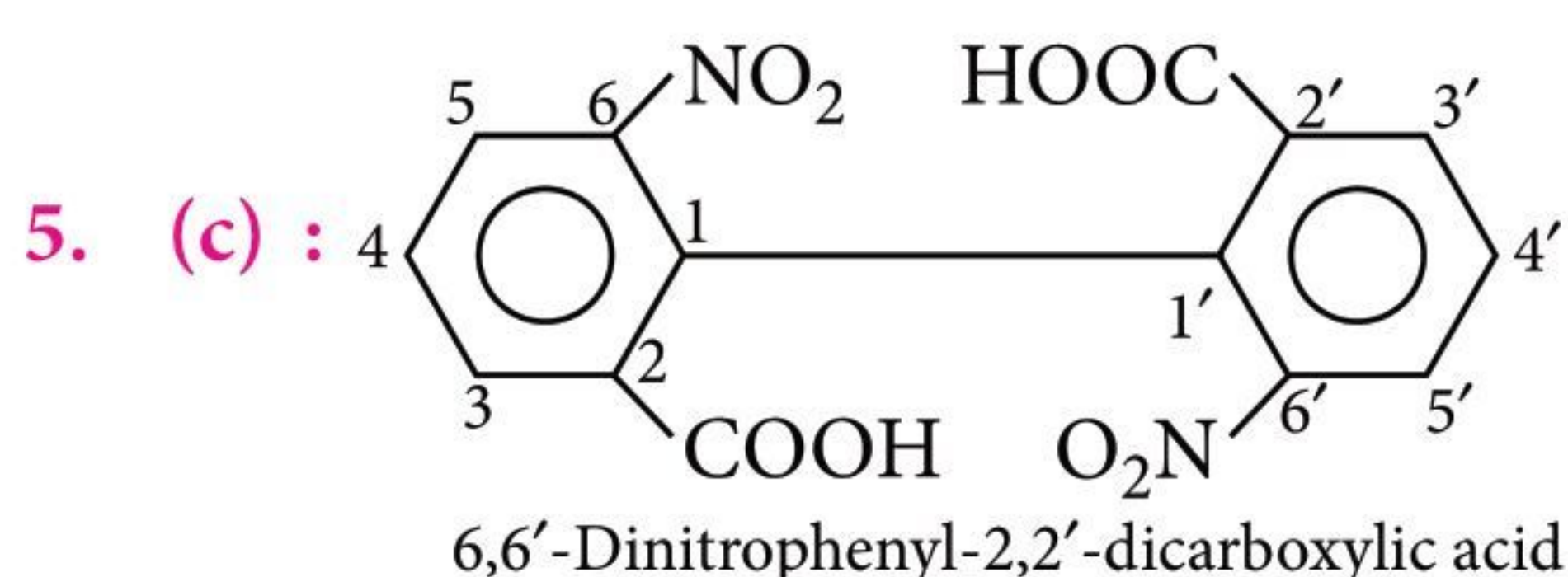
$$\text{Bond order} = \frac{10 - 6}{2} = 2.0$$

Two unpaired electrons in antibonding molecular orbital.



$$\text{Bond order} = \frac{10 - 5}{2} = 2.5$$

One unpaired electron is present in antibonding molecular orbital therefore it is paramagnetic.



6. (d) : $\lambda_A = \frac{h}{p_A}$ and $\lambda_B = \frac{h}{p_B}$

$$\text{or } \frac{\lambda_A}{\lambda_B} = \frac{p_B}{p_A} = \frac{1}{2} \quad \left(\because p_B = \frac{1}{2} p_A \right)$$

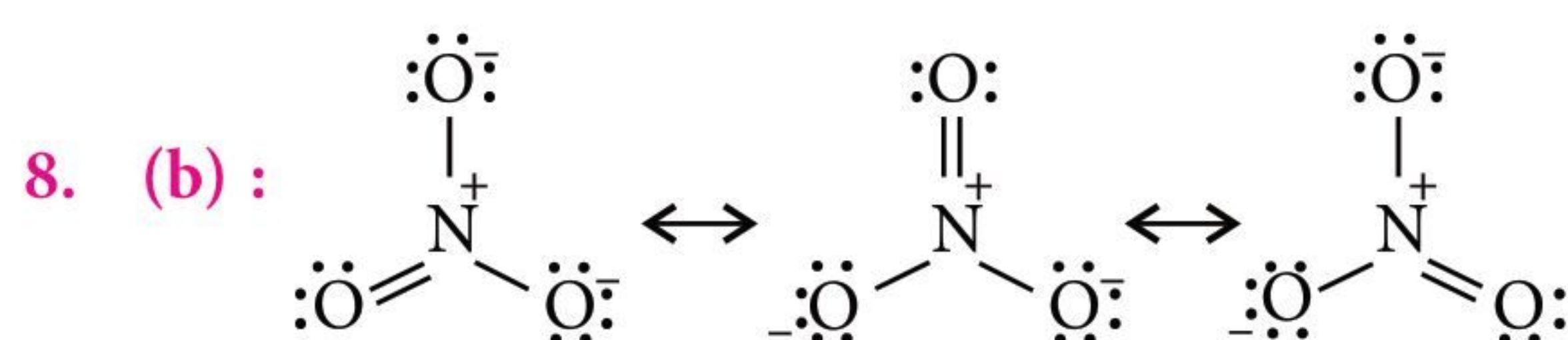
$$\text{Given : } \lambda_A = 5 \times 10^{-8} \text{ m}$$

$$\therefore \frac{5 \times 10^{-8}}{\lambda_B} = \frac{1}{2} \Rightarrow \lambda_B = 10^{-7} \text{ m}$$

7. (a) : Element with atomic number 115 has electronic configuration $[Rn]5f^{14}6d^{10}7s^27p^3$.

Probable oxidation states are +3, +5.

But due to inert pair effect, M^{3+} is the most stable cation.



Since the three resonating structures are equivalent, each should make an equal contribution to the overall hybrid. The three N—O bonds should therefore be of equal length, and each oxygen atom should bear equal $(-2/3)$ charge.

9. (a) : Non-metal hydrides are covalent hydrides.

10. (c) :

Element	%	Atomic mass	Relative number of atoms	Simplest ratio
C	40.92	12	$\frac{40.92}{12} = 3.41$	$\frac{3.41}{3.41} = 1 \times 3 = 3$
H	4.58	1	$\frac{4.58}{1} = 4.58$	$\frac{4.58}{3.41} = 1.34 \times 3 = 4$
O	54.50	16	$\frac{54.50}{16} = 3.41$	$\frac{3.41}{3.41} = 1 \times 3 = 3$

Hence, empirical formula is $C_3H_4O_3$

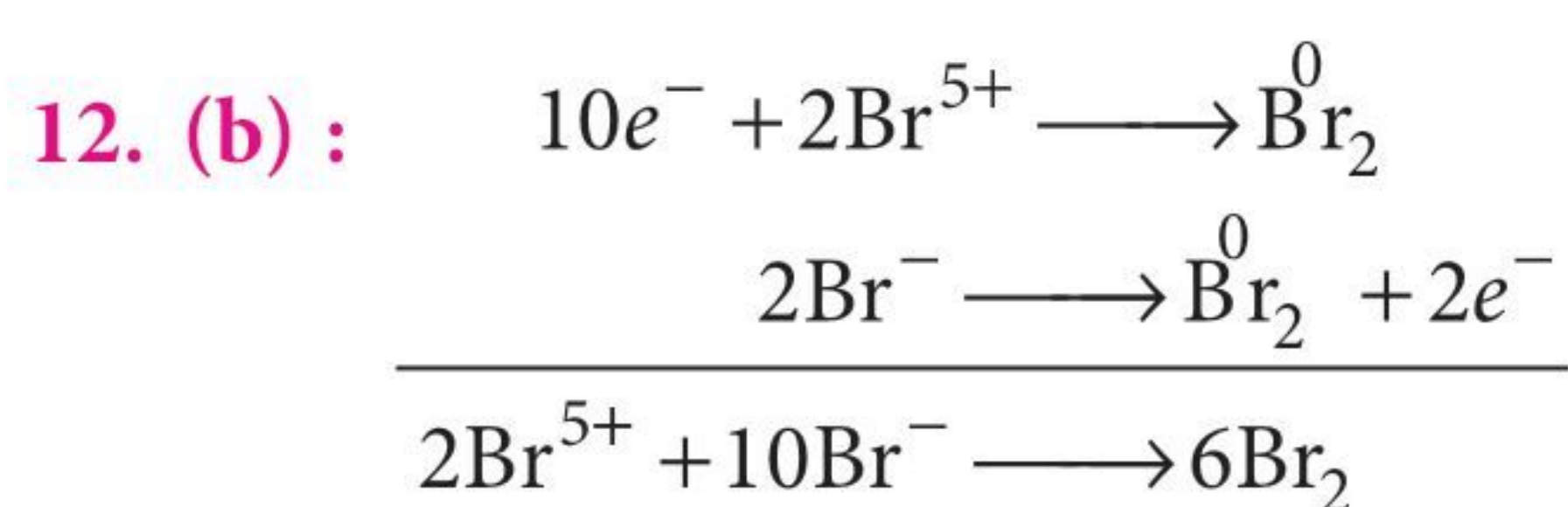
Empirical formula weight = $36 + 4 + 48 = 88$

$$n = \frac{\text{Molecular weight}}{\text{Empirical formula weight}} = \frac{176}{88} = 2$$

Thus, molecular formula = (Empirical formula) $\times n$
= $(C_3H_4O_3) \times 2 = C_6H_8O_6$

11. (c) : The formula of heavy water is D_2O , i.e., molecular mass = 20

$$\therefore \% \text{ of deuterium} = \frac{4}{20} \times 100 = 20$$

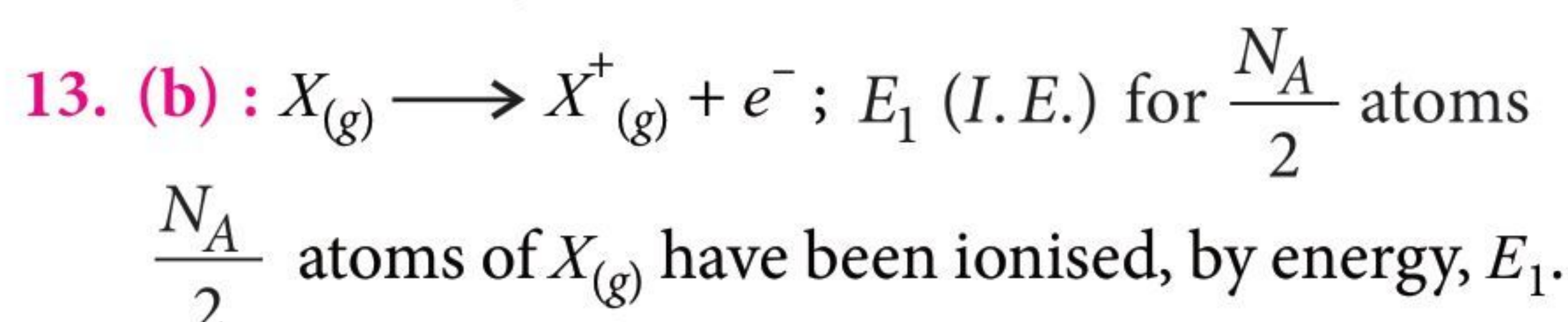


6 moles of $\text{Br}_2 = 2 \text{ moles } \text{Br}^{5+} = 10 \text{ eq. } \text{Br}^{5+} = 10 \text{ eq. } \text{Br}_2$

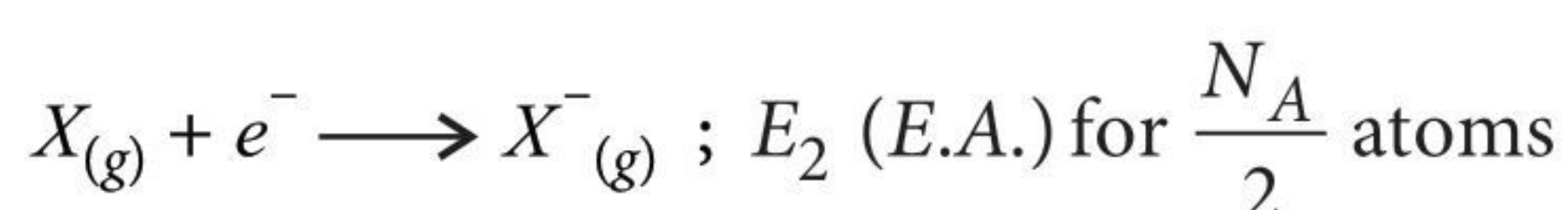
$$\therefore 1 \text{ mole } \text{Br}_2 = \frac{10}{6} \text{ eq. } \text{Br}_2 = \frac{5}{3} \text{ eq. } \text{Br}_2$$

$$\therefore n = \frac{5}{3}$$

$$\therefore E_{\text{Br}_2} = \frac{M}{5/3} = \frac{3M}{5}$$



Thus, ionisation energy $X_{(g)}$ is $\frac{2E_1}{N_A}$ per atom.



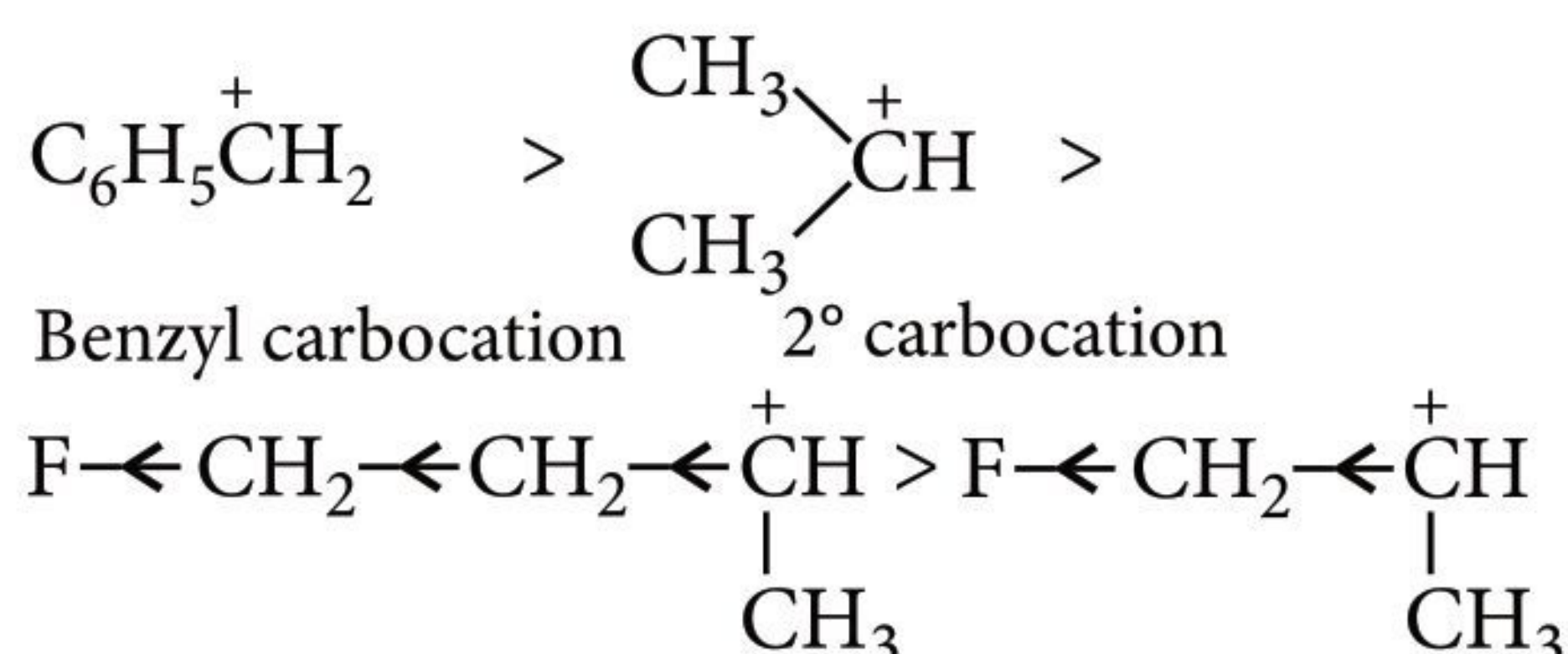
Thus, electron affinity of $X_{(g)}$ is $\frac{2E_2}{N_A}$ per atom.

14. (d) : Overlapping is better in hybrid orbitals due to same size, directional nature and equivalent energy than the pure orbitals. Among hybrid orbitals, more is the s -character greater is the strength of bond.

15. (d) : Ionization enthalpy increases on moving from left to right across the period as the size decreases, and decreases on moving top to bottom in a group as the size increases. Ar has the maximum value of I.E., since it is a noble gas. So, the correct order of increasing first ionization enthalpy ($\Delta_i H_1$) is $\text{Ba} < \text{Ca} < \text{Se} < \text{S} < \text{Ar}$.

16. (b)

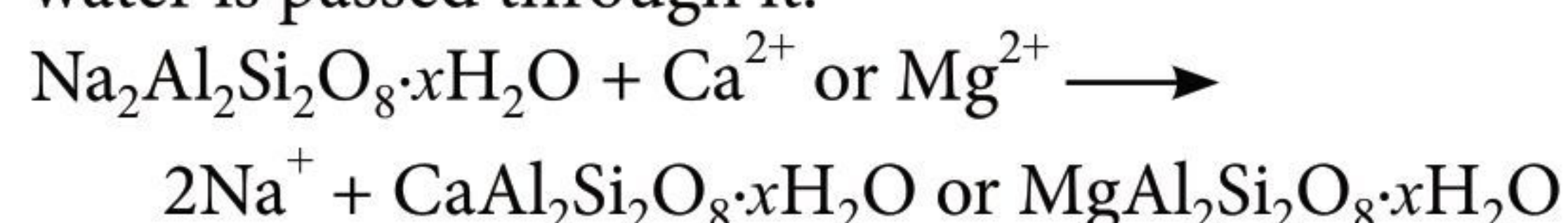
17. (c) : Higher the stability of carbocation easier will be its formation.



F destabilises the carbocation.

In structure II, F is more away from +ve charge than in I.

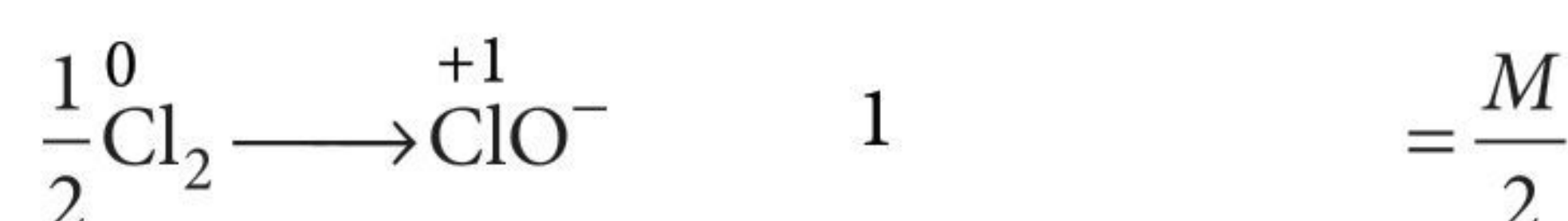
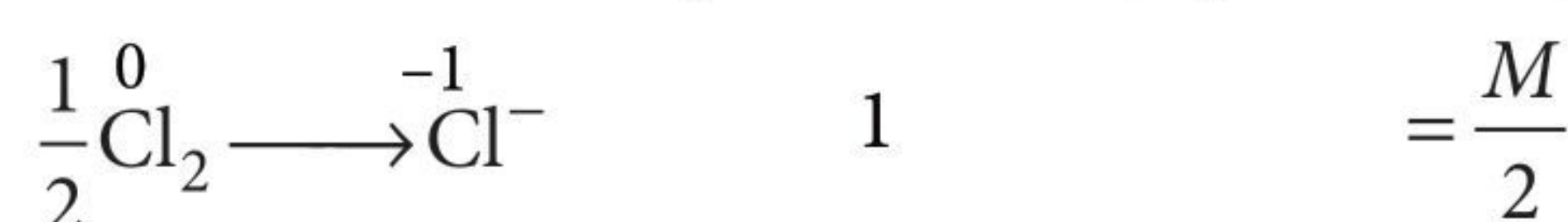
18. (a) : The sodium ions of permutit are exchanged with calcium and magnesium ions when hard water is passed through it.



19. (d) : Electron deficient species act as electrophiles i.e., NO_2^+ .

20. (b) : In a disproportionation reaction

$E(\text{oxidation part}) + E(\text{reduction part}) = \text{Net equivalent mass}$
 (Change in O.N.) (Equivalent weight)



$$\text{Net equivalent mass} = \frac{M}{2} + \frac{M}{2} = M = 71.0$$

21. (c) : Required percentage is equal to the mass percent of water in 100 g of $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$.

$$\text{mol of } \text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O} = \frac{100}{322} = 0.311 \text{ mol}$$

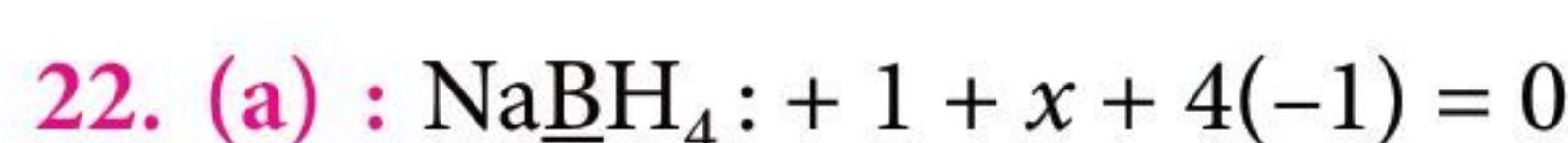
$$\text{mol of } \text{H}_2\text{O} = 0.311 \times 10 = 3.110 \text{ mol}$$

$$\text{mass of } \text{H}_2\text{O} \text{ in } 3.110 \text{ mol} = 3.110 \times 18 = 56.0 \text{ g}$$

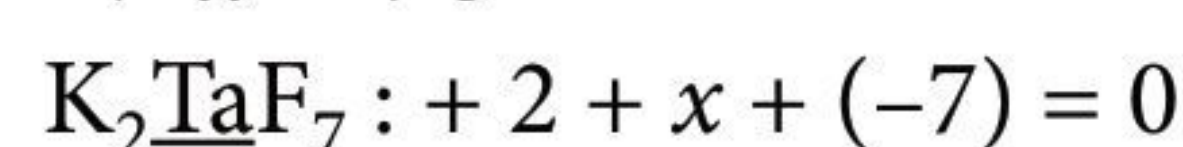
\therefore Percentage of water lost

$$= \frac{\text{Mass of } \text{H}_2\text{O} \text{ in the compound}}{\text{Molar mass of compound}} \times 100$$

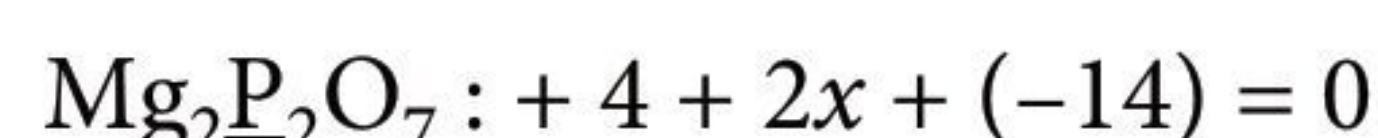
$$= \frac{56.0}{322} \times 100 = 17.4\%$$



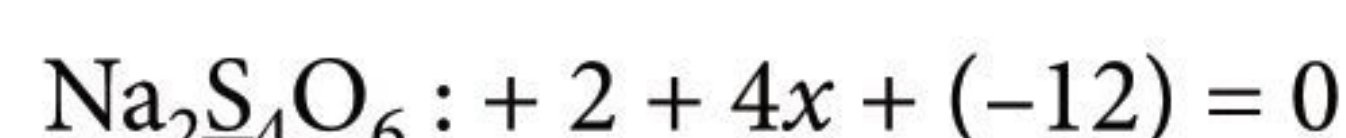
$$\Rightarrow x = +3$$



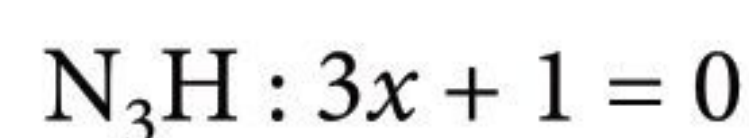
$$\Rightarrow x = +5$$



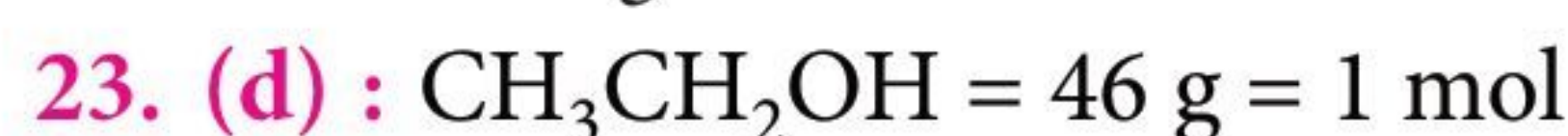
$$\Rightarrow x = +5$$



$$\text{or } 4x = 10 \Rightarrow x = +2.5$$

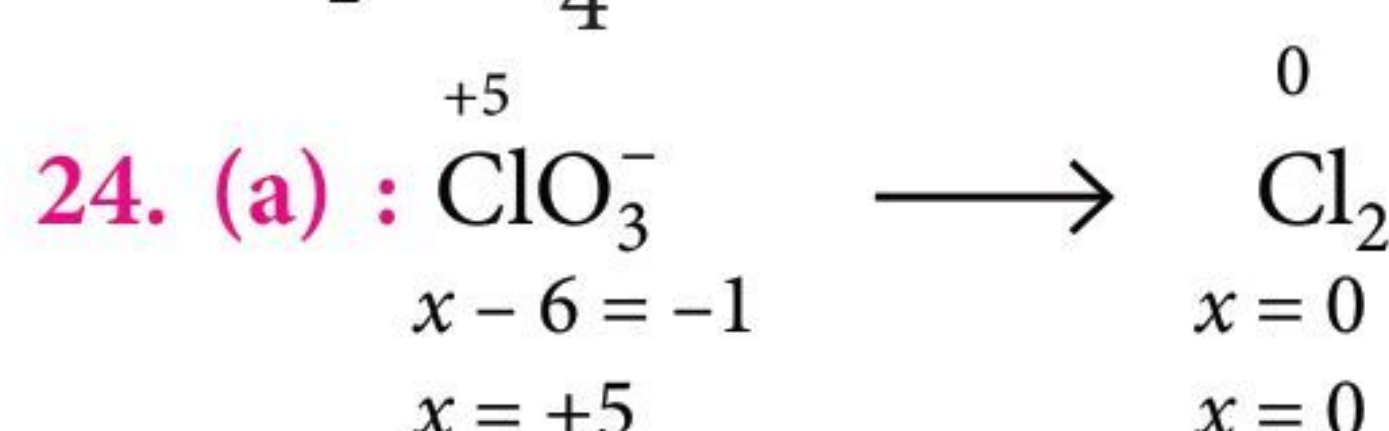


$$\Rightarrow x = -\frac{1}{3}$$



$$\text{H}_2\text{O} = 18 \text{ g} = 1 \text{ mol}$$

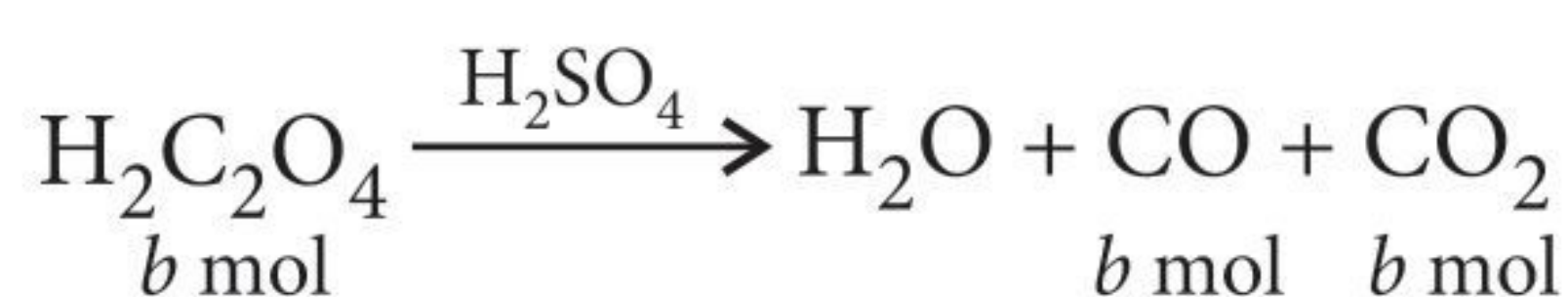
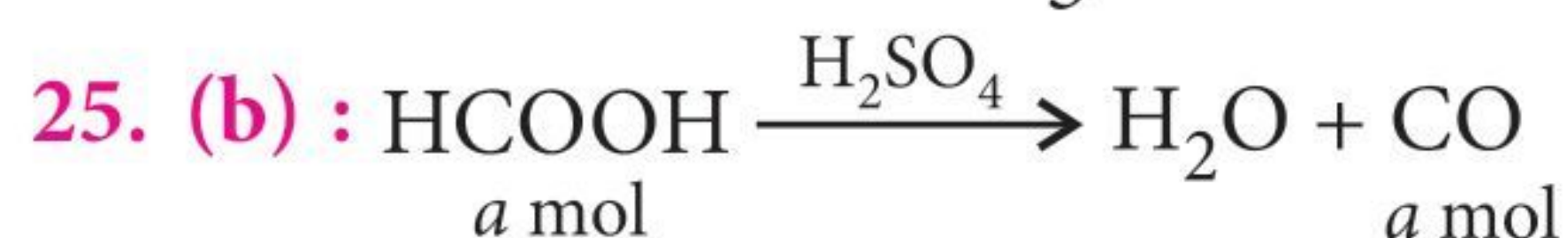
$$x_{\text{H}_2\text{O}} = \frac{3}{4} = 0.75$$



Oxidation number has changed by 5

$$\text{Equivalent mass} = \frac{\text{Molecular mass}}{\text{Change in oxidation number}}$$

$$= \frac{84.45}{5} = 16.89 \text{ g}$$

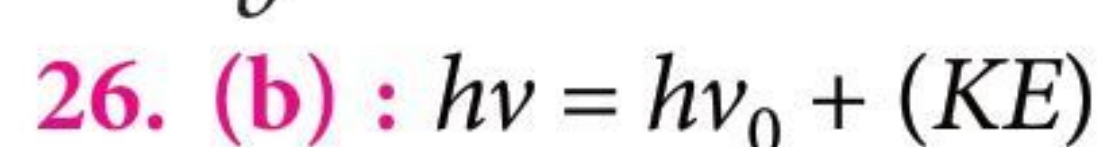


Total number of moles of gases formed = $a + 2b$

Moles of gas (CO_2) absorbed by KOH = b

Hence, $b = \frac{1}{6}(a + 2b)$ (\because Volume \propto moles)

$$\frac{a}{b} = 4$$



$$KE = h(\nu - \nu_0)$$

$$(KE)_1 = h(3.2 \times 10^{16} - \nu_0), (KE)_2 = h(2.0 \times 10^{16} - \nu_0)$$

$$\text{Given, } (KE)_1 = 2(KE)_2$$

$$h(3.2 \times 10^{16} - \nu_0) = 2h(2.0 \times 10^{16} - \nu_0)$$

$$\therefore \nu_0 = 8.0 \times 10^{15} \text{ Hz}$$

27. (c) : Since, water is polar in nature and like dissolves like, the coating must be non-polar to polar manner.

28. (c) : In structure (c), all the atoms have complete octet. Thus, it is the correct representation of carbon suboxide.

29. (c) : D_2O has higher freezing point (3.8°C) than H_2O (0°C).

30. (c)

31. (a) : On the basis of hyperconjugation effect of the alkyl groups, the order of stability of free radicals is as follows :

tertiary > secondary > primary.

Benzyl free radicals are stabilised by resonance and hence are more stable than alkyl free radicals.

Further as the number of phenyl group attached to the carbon atom holding the odd electron increases, the stability of a free radical increases accordingly.

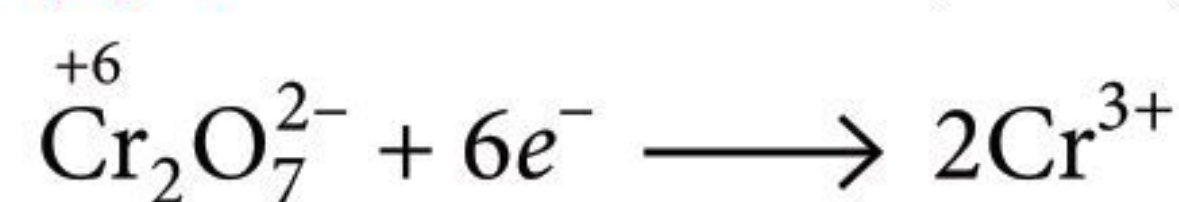
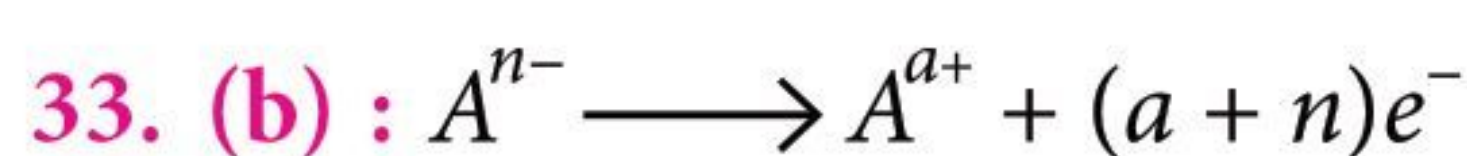
$$\text{i.e., } (\text{CH}_3)_2\dot{\text{C}}\text{H} < (\text{CH}_3)_3\dot{\text{C}} < (\text{C}_6\text{H}_5)_2\dot{\text{C}}\text{H} < (\text{C}_6\text{H}_5)_3\dot{\text{C}}$$

32. (c) : The limiting line of Balmer series refers to the transition of electron from ∞ to 2^{nd} orbit.

$$\nu = c\bar{\nu} = 3 \times 10^{10} \text{ cm s}^{-1} \times 109677 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \text{ cm}^{-1}$$

$$= 3.29 \times 10^{15} \left(\frac{1}{4} - \frac{1}{\infty} \right) \text{ s}^{-1} \quad (\because n_1 = 2, n_2 = \infty)$$

$$= 8.22 \times 10^{14} \text{ s}^{-1}$$



Also $M_{\text{eq.}}$ of $A = M_{\text{eq.}}$ of $\text{K}_2\text{Cr}_2\text{O}_7$

$$3.26 \times 10^{-3}(a + n) = 1.68 \times 10^{-3} \times 6$$

$$\text{or } a + n = 3$$

$$\Rightarrow a = 3 - n$$



$(IE)_3$ is very high thus, M^{2+} is stable with inert gas configuration. Thus, element belongs to alkaline earth metals.

35. (c) : Large the number of moles of atom larger will be the number of atoms.

(a) No. of atoms in 1 g of Au

$$= \frac{1}{197} \times 6.022 \times 10^{23} = 3.057 \times 10^{21} \text{ atoms}$$

(b) No. of atoms in 1 g of Na = $\frac{1}{23} \times 6.022 \times 10^{23}$

$$= 2.618 \times 10^{22} \text{ atoms}$$

(c) No. of atoms in 1 g of Li = $\frac{1}{7} \times 6.022 \times 10^{23}$

$$= 8.602 \times 10^{22} \text{ atoms}$$

(d) No. of atoms of 1 g of Cl_2 = $\frac{1}{71} \times 2 \times 6.022 \times 10^{23}$

$$= 1.696 \times 10^{22} \text{ atoms}$$

\therefore 1 g of Li has largest number of atoms.

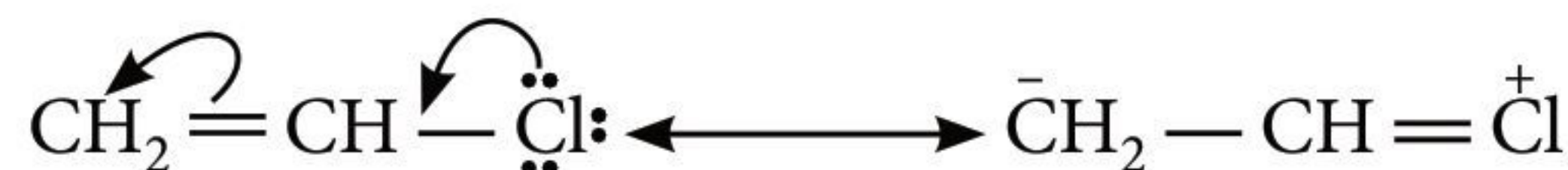


Number of moles of H_2S = Number of moles of

$$\text{CuCl}_2 = \frac{0.75}{134.5} = 0.00558$$

$$\text{Volume of } \text{H}_2\text{S} \text{ at STP} = 0.00558 \times 22400 = 125 \text{ mL}$$

37. (b) : In vinyl chloride, because of resonance C—Cl bond acquires some double bond character which makes it less reactive.



38. (c) : Sodium hexametaphosphate, $\text{Na}_2[\text{Na}_4(\text{PO}_3)_6]$ or $\text{Na}_6\text{P}_6\text{O}_{18}$, commercially called 'calgon' is used to remove permanent hardness of water.

39. (c) : Here, P is $4\pi r^2 R^2$.

40. (a) : Caro's acid : H_2SO_5 ; O.S. = +6

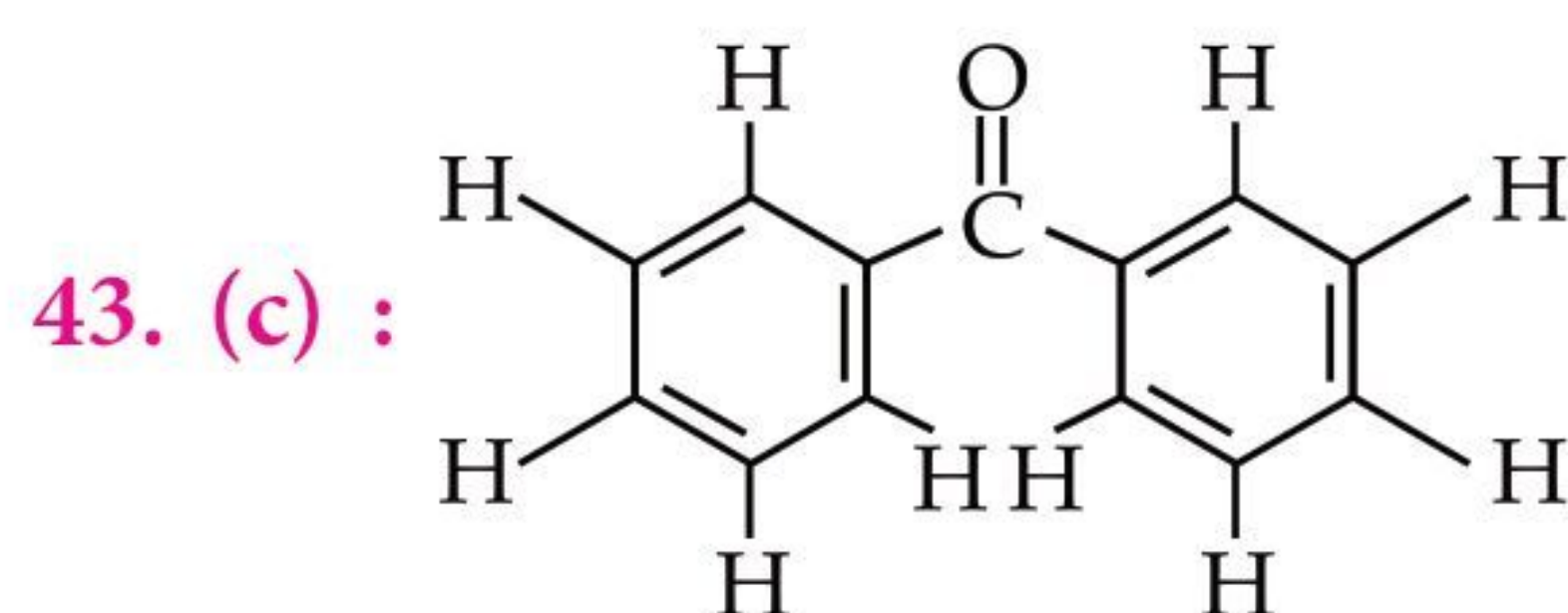
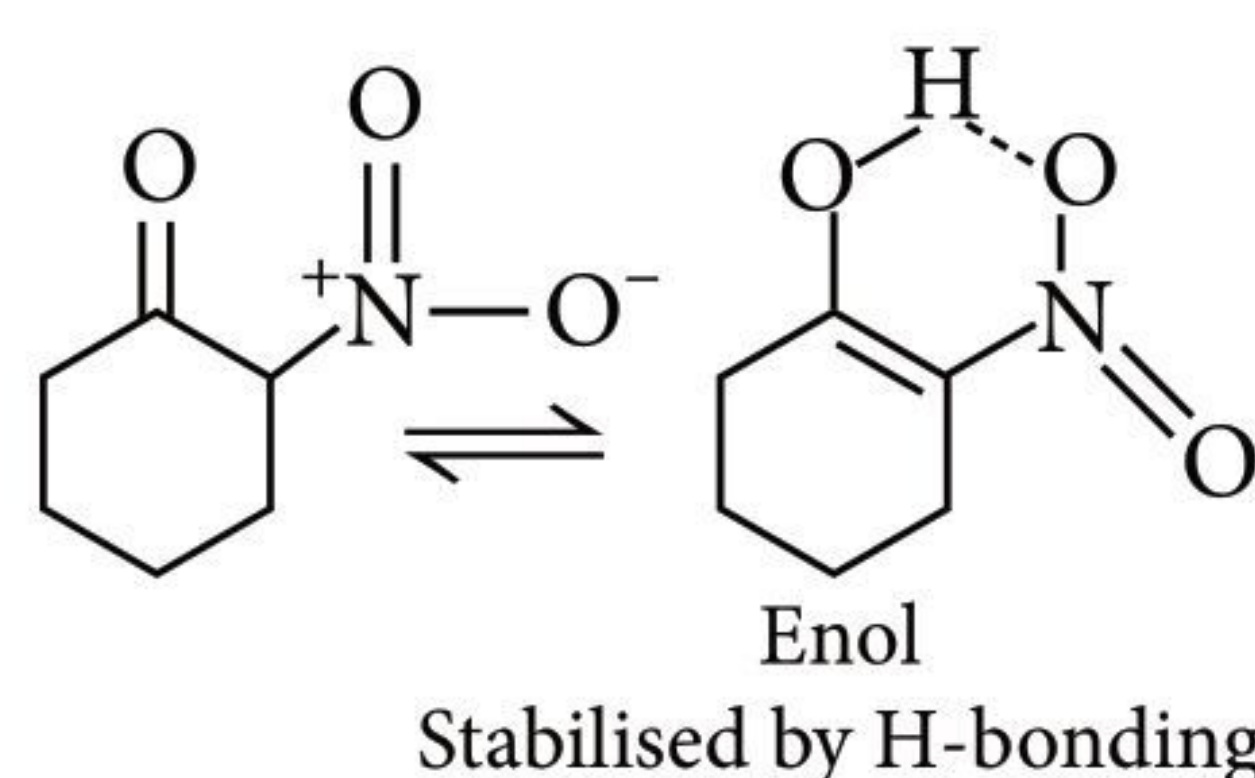
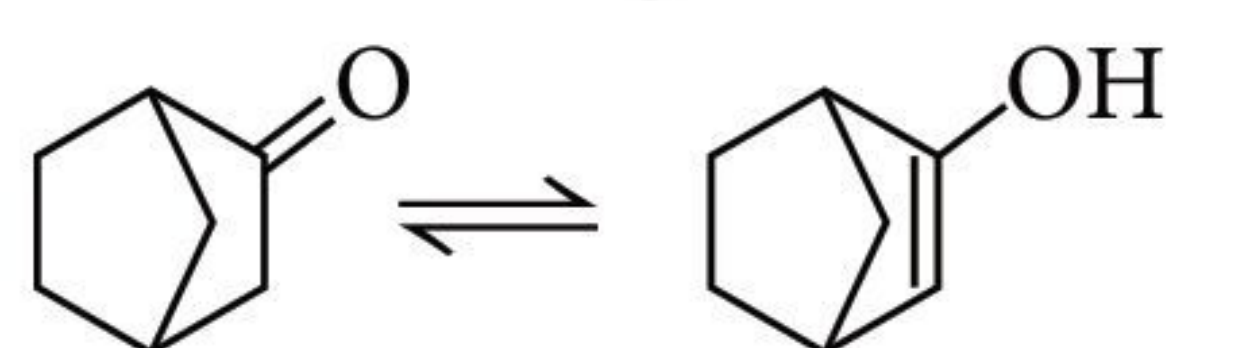
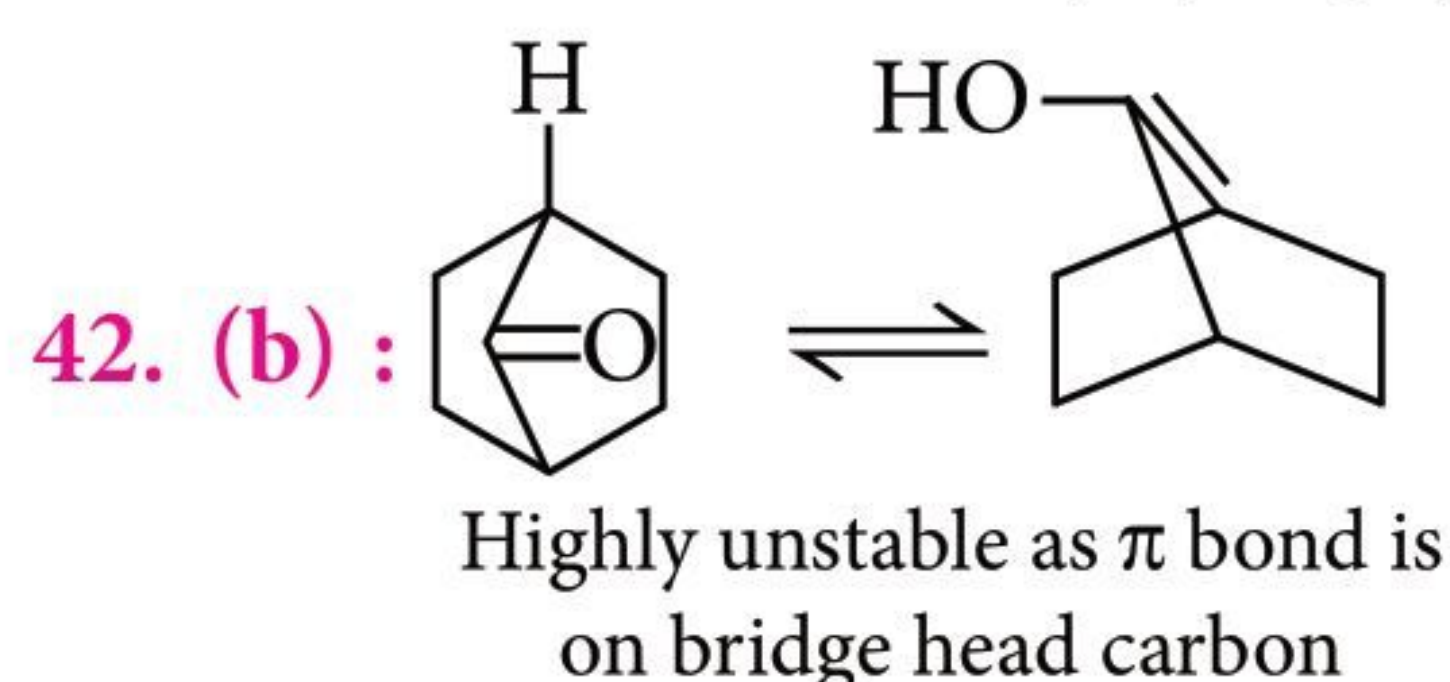
Marshall's acid : $\text{H}_2\text{S}_2\text{O}_8$; O.S. = +6

41. (d) : In general, electron affinity increases across the period on account of increase of Z_{eff} while

decreases on moving down the group on account of increase of size. Elements (i) and (iii) are succeeding members of the 2nd period and belong to group 17 and 16, respectively, while elements (ii) and (iv) are succeeding members of the 3rd period and belong to group 17 and 16, respectively. (i) is F, (ii) is Cl, (iii) is O, while (iv) is S.

However, O and F have unexpectedly low electron affinities on account of relatively small size.

Thus, the correct order of electron affinity is $O < S < F < Cl$, i.e., (iii) < (iv) < (i) < (ii).



No. of σ bonds = 25

No. of π bonds = 7

44. (d) :

Element	%	At. mass	Relative number of moles	Simplest ratio
Xe	53.5	131	0.408	1
F	46.5	19	2.44	6

\therefore The empirical formula is XeF_6 .

\therefore Oxidation state of Xe is +6.

45. (b) : Both statements are true but independent of each other.

46. (a)

47. (c) : Each H_2O molecule is linked to four other H_2O molecules through hydrogen bonds.

48. (c) : Water softened by Permutit process is not demineralised water since it still contains sodium salts.

49. (a)

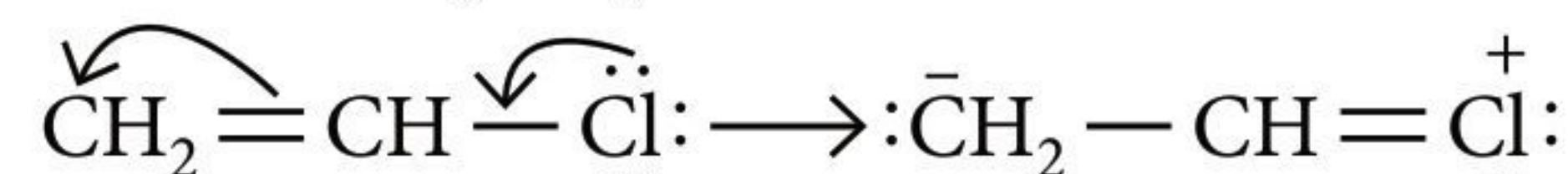
50. (b)

51. (d) : Maximum number of electrons in p -subshell = 6

52. (c) : XeOF_4 : sp^3d^2 hybridisation

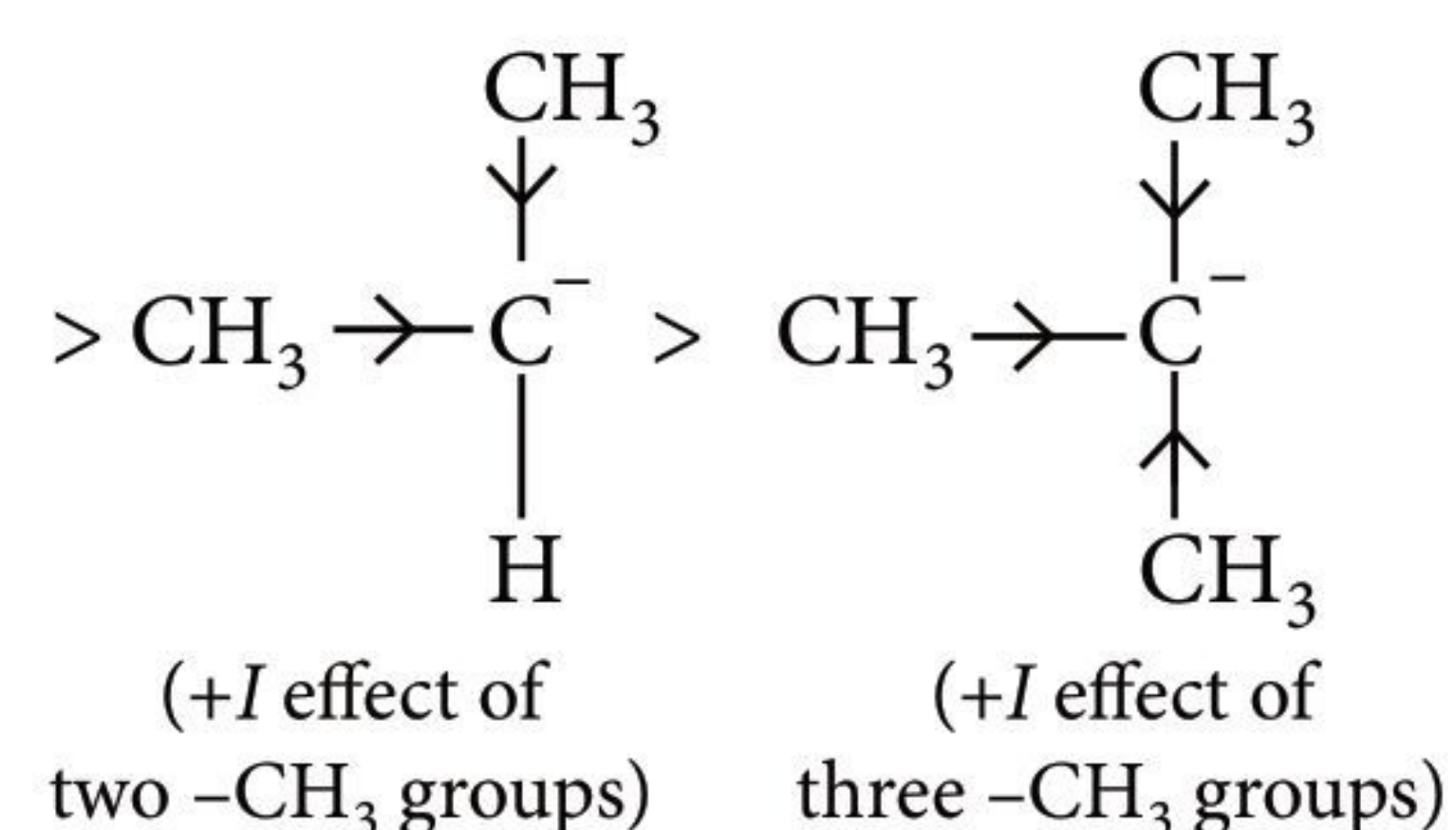
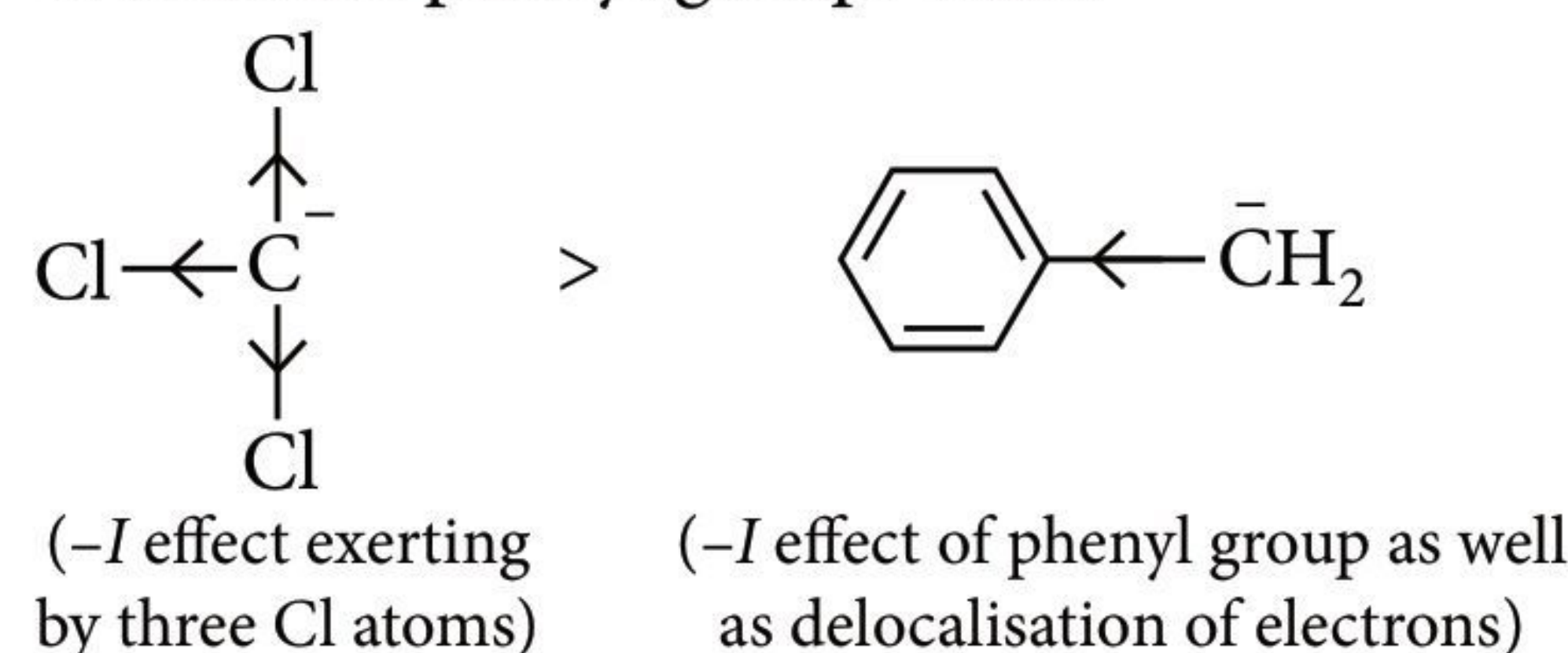
IF_2^- : sp^3d hybridisation

53. (a) : The dipole moment of vinyl chloride is lower than that of $\text{CH}_3\text{CH}_2\text{Cl}$ due to resonance effect.

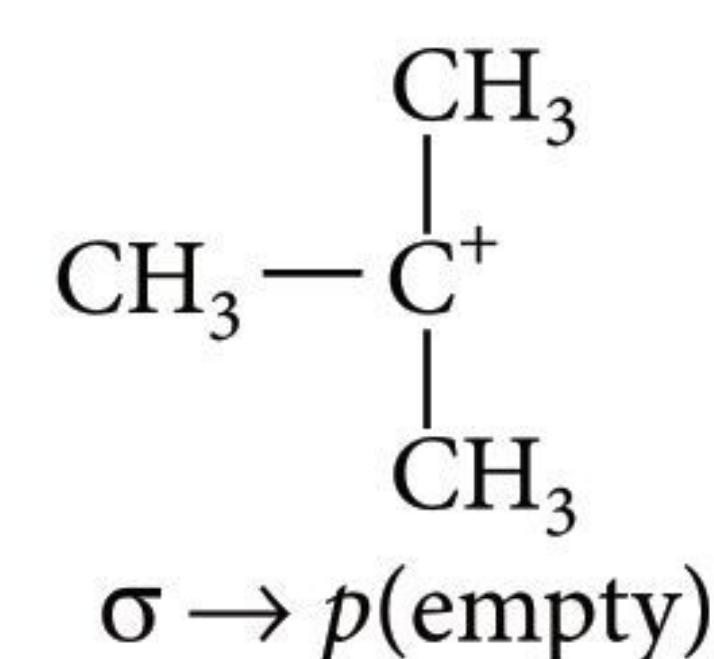


54. (c) : $-I$ effect (e^- withdrawing) exerting groups stabilise carbanion by the dispersal of their $-ve$ charge while $+I$ effect (e^- releasing) exerting groups destabilise the carbanion by increasing electron density on them.

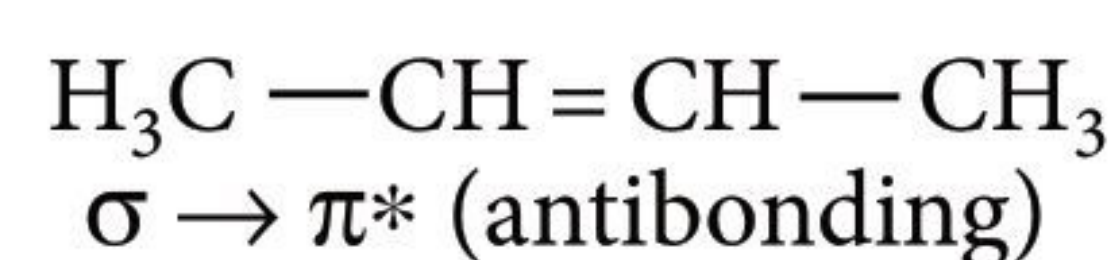
On the other hand, resonance stabilised carbanion are stable due to the involvement of their lone pair of electrons with the delocalization of π -electrons of attached phenyl group. Thus,



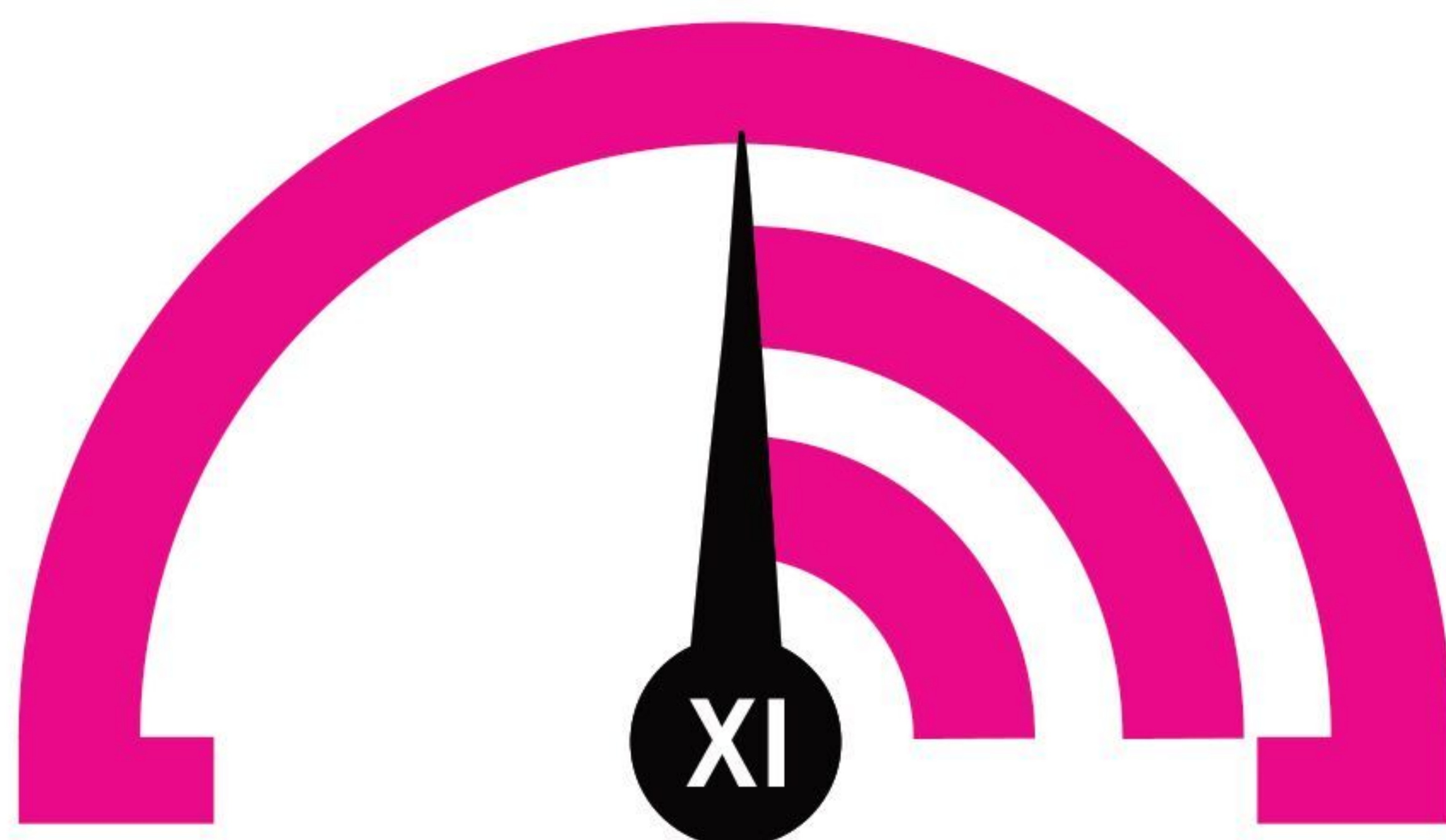
55. (a) : In case of *tert*-butyl cation, the hyperconjugation is due to the interaction of the electrons in the σ bond with adjacent empty p -orbital.



In case of 2-butene, the hyperconjugation is due to the interaction of σ orbital with antibonding π^* -orbital.



MONTHLY TEST DRIVE



This specially designed column enables students to self analyse their extent of understanding of specified chapters. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

Total Marks : 120 Some Basic Concepts of Chemistry | Structure of Atom Time Taken : 60 Min.

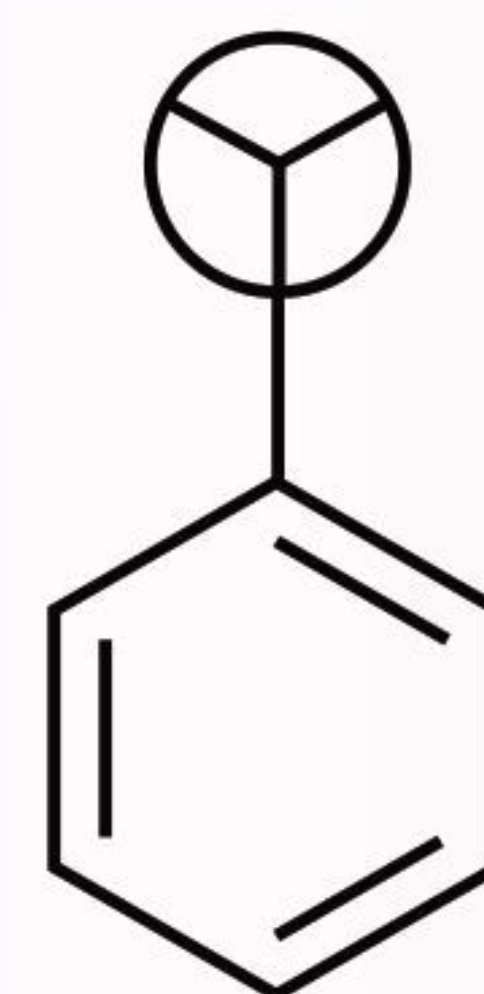
NEET

Only One Option Correct Type

- One isotope of a non-metallic element (X) has mass number 127 and 74 neutrons in the nucleus. The anion derived from the isotope has 54 electrons. Hence, symbol for the anion is
(a) ${}_{54}^{127}\text{X}^-$ (b) ${}_{53}^{127}\text{X}^-$ (c) ${}_{53}^{74}\text{X}^-$ (d) ${}_{54}^{74}\text{X}^-$
- Analysis of chlorophyll shows that it contains 2.68 percent magnesium. How many atoms of magnesium does 100 g of chlorophyll contain?
(a) 6.72×10^{22} atoms (b) 7.61×10^{22} atoms
(c) 6.72×10^{23} atoms (d) 6.022×10^{22} atoms
- One mole of P_4 molecules contains
(a) 1 molecule
(b) 4 molecules
(c) $\frac{1}{4} \times 6.022 \times 10^{23}$ atoms
(d) 24.092×10^{23} atoms.
- If the radius of 2nd Bohr orbit of hydrogen atom is r_2 . The radius of 3rd Bohr orbit will be
(a) $\frac{4}{9}r_2$ (b) $4r_2$ (c) $\frac{9}{4}r_2$ (d) $9r_2$
- Find the quantum no. 'n' corresponding to the excited state of He^+ ion if on transition to the ground state that ion emits two photons in succession with wavelengths 108.5 nm and 30.4 nm.
(a) 5 (b) 7 (c) 2 (d) 4
- If Avogadro number N_A , is changed from $6.022 \times 10^{23} \text{ mol}^{-1}$ to $6.022 \times 10^{20} \text{ mol}^{-1}$, this would change
(a) the mass of one mole of carbon
(b) the ratio of chemical species to each other in a balanced equation
(c) the ratio of elements to each other in a compound
(d) the definition of mass in units of grams.
- A particular electromagnetic radiation with wavelength 200 nm
(a) has a higher frequency than radiation with wavelength 400 nm
(b) is in the visible region of the electromagnetic spectrum
(c) has a greater speed in vacuum than does radiation of wavelength 400 nm
(d) has a greater energy content per photon than does radiation with wavelength 100 nm.
- Cortisone is a molecular substance containing 21 atoms of carbon per molecule. The mass percentage of carbon in cortisone is 69.98%. Its molar mass is
(a) 176.5 (b) 252.2 (c) 287.6 (d) 360.1
- The two electrons X and Y have following sets of quantum numbers :
.....



COMIC CAPSULE



Mercedes Benzene

$$\begin{array}{cccc} n & l & m_l & m_s \\ X = 3, & 2, & -2, & +\frac{1}{2} \\ Y = 3, & 0, & 0, & +\frac{1}{2} \end{array}$$

Which of the following is the correct statement?

- (a) X and Y have same energy.
 (b) X has greater energy than Y.
 (c) X has less energy than Y.
 (d) X and Y represent same electron.
10. When a certain metal was irradiated with light of frequency 3.2×10^{16} Hz, photoelectrons emitted had twice the kinetic energy as did photoelectrons emitted when the same metal was irradiated with light of frequency 2.0×10^{16} Hz. Hence, threshold frequency is
 (a) 0.8×10^{15} Hz (b) 8.0×10^{15} Hz
 (c) 0.85×10^{14} Hz (d) 6.4×10^{16} Hz
11. Photoelectric effect is the phenomenon in which
 (a) photons come out the metal when hit by a beam of electrons
 (b) photons come out of the nucleus of an atom under the action of an electric field
 (c) electrons come out of metal with a constant velocity which depends on frequency and intensity of incident light
 (d) electrons come out of metal with different velocities not greater than a certain value which depends upon frequency of incident light and not on intensity.
12. 5 mole of SO_2 and 5 moles of O_2 are allowed to react to form SO_3 in closed vessel. At the equilibrium stage, 60% of SO_2 is used up. The total number of moles of SO_2 , O_2 and SO_3 in the vessel now is
 (a) 10.5 (b) 3.9 (c) 10.0 (d) 8.5

Assertion & Reason Type

Directions : In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
 (b) If both assertion and reason are true but reason is not the correct explanation of assertion.
 (c) If assertion is true but reason is false.
 (d) If both assertion and reason are false.
13. **Assertion :** Bohr's orbits are called stationary orbits.
Reason : Electrons remain stationary in these orbits for some time.
14. **Assertion :** The sum of mole fractions of all the components of a solution is unity.

Reason : Mole fraction is temperature dependent mode of concentration.

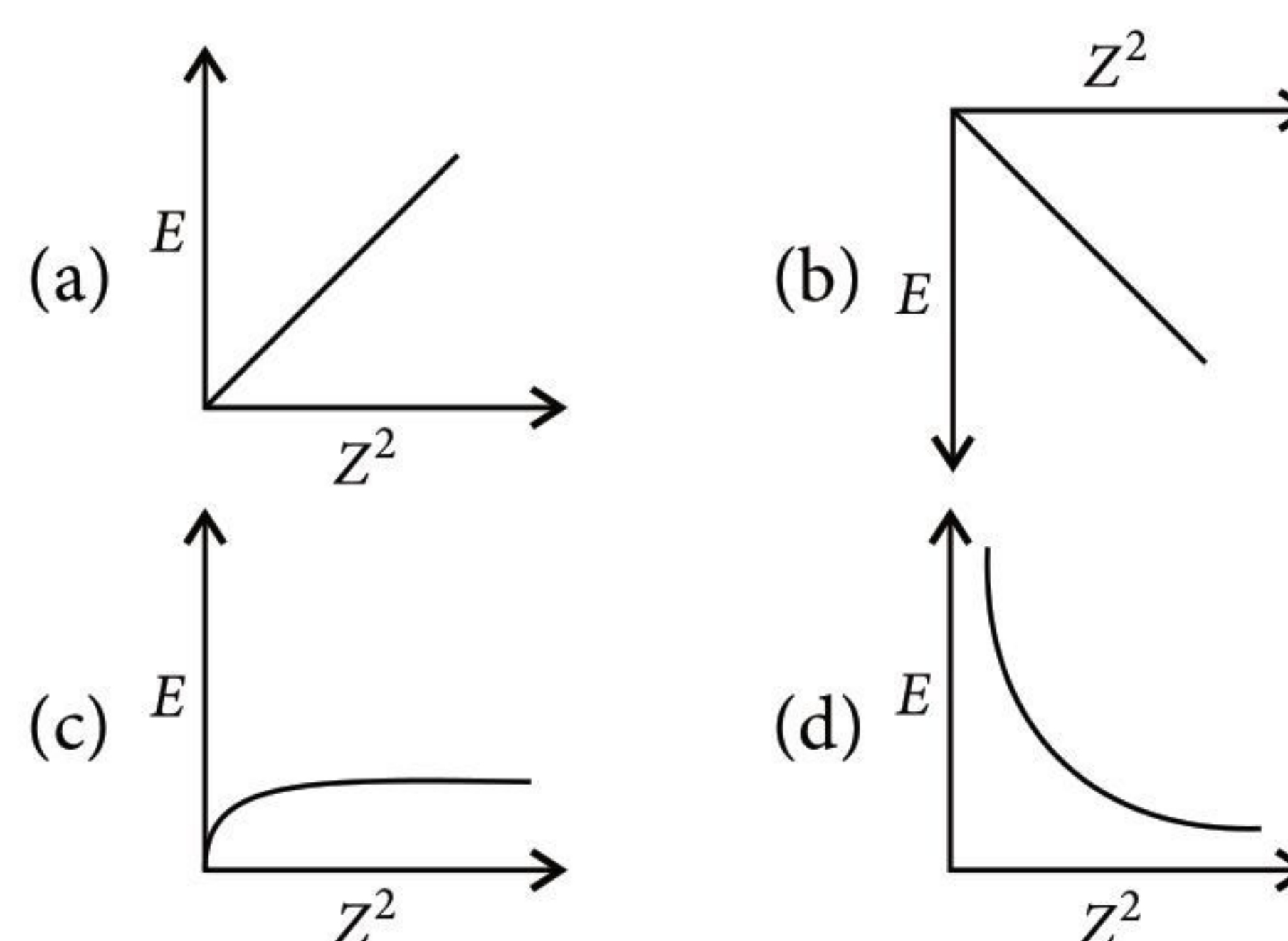
15. **Assertion :** If the potential applied on the electron is quadrupled, the de-Broglie wavelength associated with the electron is halved.

Reason : If the potential applied on the electron is quadrupled, velocity is doubled and hence λ is halved.

JEE MAIN / JEE ADVANCED

Only One Option Correct Type

16. The energy of an electron moving in n^{th} Bohr's orbit of an element is given by $E_n = \frac{-13.6}{n^2} Z^2$ eV/atom. The graph of E vs Z^2 (keeping 'n' constant) will be



17. $A + 2B + 3C \rightleftharpoons AB_2C_3$
 Reaction of 6.0 g of A, 6.0×10^{23} atoms of B, and 0.036 mol of C yields 4.8 g of compound AB_2C_3 . If the atomic mass of A and C are 60 and 80 amu, respectively, the atomic mass of B is (Avogadro no. = 6×10^{23})
 (a) 70 amu (b) 60 amu (c) 50 amu (d) 40 amu

mtg

NEET ONLINE TEST SERIES

Practice Part Syllabus/ Full Syllabus
24 Mock Tests

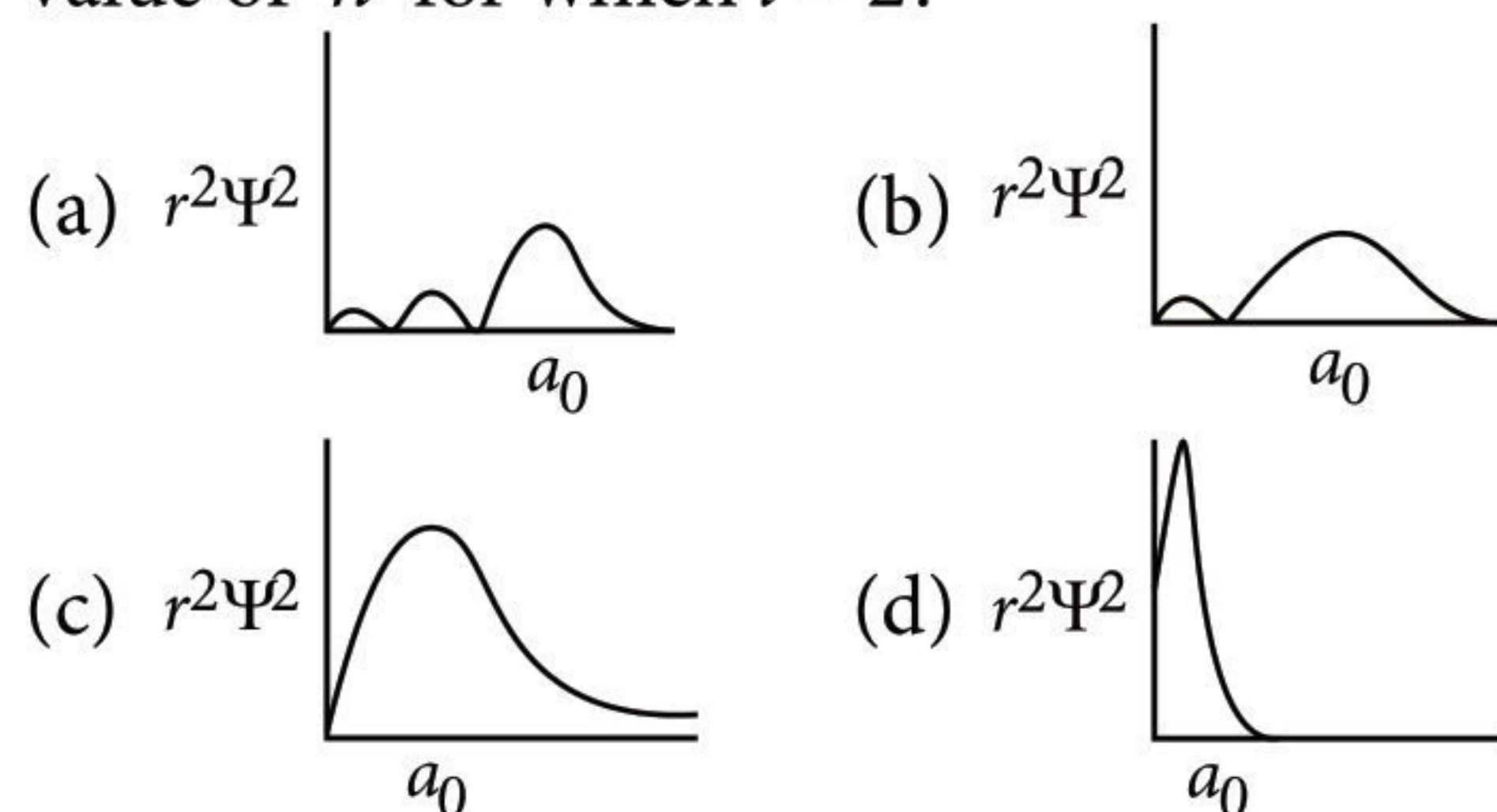
Now on your android Smart phones
with the same login of web portal.

Log on to test.pcmbtoday.com

18. An alloy has Fe, Co and Mo equal to 71%, 12% and 17% respectively. How many cobalt atoms are there in a cylinder of radius 2.50 cm and a length of 10.0 cm? (The density of alloy is 8.20 g/mL. Atomic weight of cobalt is 58.9.)

- (a) 2×10^{23} (b) 19.8×10^{22}
(c) 19.8×10^{23} (d) 5.1×10^{23}

19. Which of the following radial distribution graphs corresponds to $l = 2$ for the H atom for the minimum value of 'n' for which $l = 2$?



More than One Options Correct Type

20. A certain oxide of iodine has been found to contain iodine and oxygen. The ratio iodine : oxygen is 254 : 112. On being dissolved in water this oxide can produce

- (a) HIO_2 (b) HIO_3
(c) HIO_4 (d) H_5IO_6

21. Which of the following sets of quantum number is/are not allowed?

- (a) $n = 3, l = 2, m = -1$ (b) $n = 2, l = 3, m = -1$
(c) $n = 3, l = 0, m = 1$ (d) $n = 6, l = 2, m = -1$

22. Given below are few statements. Mark the statements which are correct.

- (a) Gram atomic mass of an element may be defined as the mass of Avogadro's number of atoms.
(b) The molecular mass of a diatomic elementary gas is twice its atomic mass.
(c) Gay Lussac's law of chemical combination is valid for all substances.
(d) A pure compound has always a fixed proportion of masses of its constituents.

23. Which of the following is/are not correct?

- (a) Isotones differ in the number of neutrons.
(b) Isobars contain the same number of neutrons but differ in the number of protons.
(c) No isotope of hydrogen is radioactive.
(d) Density of nucleus is much greater than that of atom.

Integer / Numerical Value Type

24. A microscope using suitable photons is employed to locate an electron in an atom within a distance of

0.1 Å. The uncertainty involved in the measurement of velocity is $5.79 \times 10^x \text{ m s}^{-1}$. The value of x is _____.

25. A plant virus is found to consist of uniform cylindrical particles of 150 Å in diameter and 5000 Å long. The specific volume of the virus of $0.475 \text{ cm}^3/\text{g}$. If the virus is considered to be a single particle, its molar mass is $x \times 10^7$. Find the value of x .

26. An ion with mass number 56 contains 3 units of positive charge and 30.4% more neutrons than the electrons. The number of electrons in the neutral atom is $(5a + 1)$. The value of a is _____.

Comprehension Type

The atomic mass of an atom (element) is not its actual mass. It is relative mass as compared with an atom of carbon taken as 12. It is expressed in amu (u). The actual mass of an atom means its mass in grams which is obtained by dividing the atomic mass of the element by Avogadro's number (6.022×10^{23}) because one gram atom contains Avogadro's number of atoms.

27. Which of the following has maximum mass?

- (a) 0.1 moles of ammonia
(b) 1120 cc of carbon dioxide at STP
(c) 0.1 g atom of carbon
(d) 6.022×10^{22} molecules of H_2 gas

28. 5.6 L of a gas at NTP are found to have a mass of 11 g. The molecular mass of the gas is

- (a) 36 (b) 48
(c) 40 (d) 44

Your favourite MTG Books/Magazines available in JAMMU & KASHMIR at

Kabli Book Stall - Anantnag Ph: 8803043296, 9906460029

New Valley Book Depot - Anantnag Ph: 9469183540

Sharjha Book Depot - Anantnag Ph: 9419040456

Harnam Dass & Bro'S - Jammu Ph: 0191-2542175, 2574428; 9419664141

Sahitya Sangam - Jammu Ph: 0191-2579593, 2562191, 2579593; 9419190177

Shiela Book Centre - Jammu Ph: 0191-2574912; 9419146803

Kapoor Sons - Srinagar Ph: 0194-2456458; 9419425757, 9419069199

Kashmir Book Depot - Srinagar Ph: 2450262, 474440, 2475973; 9906726231, 9419761773

Shah Book Centre - Srinagar Ph: 9906763627, 9419062444

Abdullah News Agency - Srinagar Ph: 0194-2472621, 2435057; 9419074859

Highway Book Shop - Srinagar Ph: 9858304786

Paradise Book House - Srinagar Ph: 9419067856

Visit "MTG IN YOUR CITY" on www.mtg.in to locate nearest book seller OR write to info@mtg.in OR call **0124-6601200** for further assistance.

Matrix Match Type

29. 1 mole of the compound given in Column I is to be oxidised to the compound as indicated. Compare the reactions in Column I with the moles of O_2 required in Column II and select the answer from the codes given.

Column I				Column II			
(A)	$CO \longrightarrow CO_2$	(P)	0.5 mol	(Q)	1.5 mol	(R)	2.0 mol
(B)	$N_2 \longrightarrow N_2O_4$	(Q)	1.5 mol	(R)	2.0 mol	(S)	5.0 mol
(C)	$P_4 \longrightarrow P_2O_5$	(R)	2.0 mol	(S)	5.0 mol		
(D)	$Cl_2 \longrightarrow Cl_2O_3$						
A	B	C	D				
(a)	S	Q	P	R			
(b)	Q	S	R	P			
(c)	P	R	S	Q			
(d)	P	Q	S	R			

30. Match the List I with List II and select the correct answer using the code given below the lists :

List I (Observation of scattering expt.)			List II (Conclusion drawn)		
P.	Some α -particles were deflected back after striking thin foil of gold.		1.	There is a positively charged body within the atom.	
Q.	Most of the α -particles passed through the foil without undergoing any deflection.		2.	The positively charged body occupies a very small volume.	
R.	The number of α -particles deflected back was very small.		3.	There is sufficient empty space within the atom.	
P	Q	R			
(a)	1	3	2		
(b)	2	1	3		
(c)	2	3	1		
(d)	1	2	3		

Keys are published in this issue. Search now! ☺

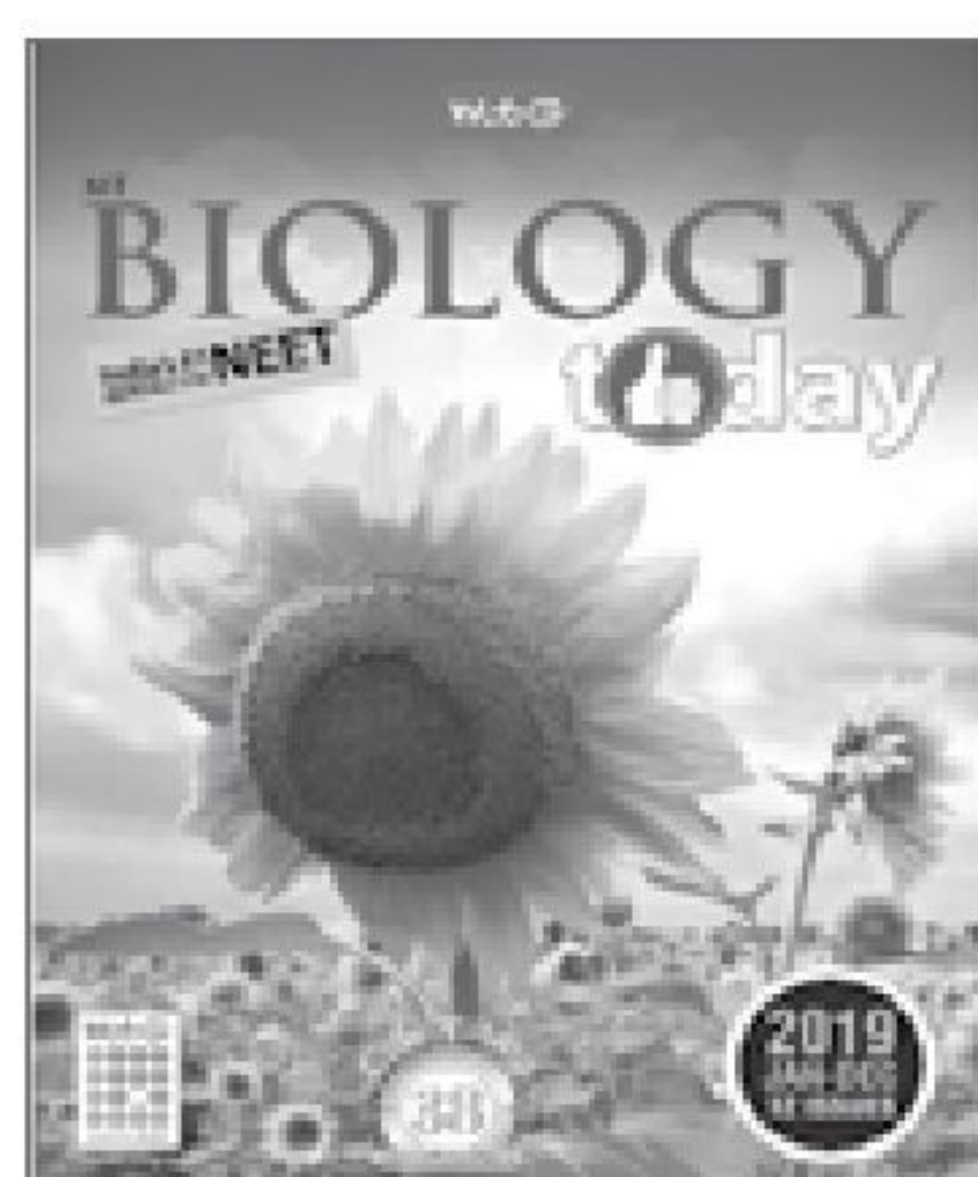
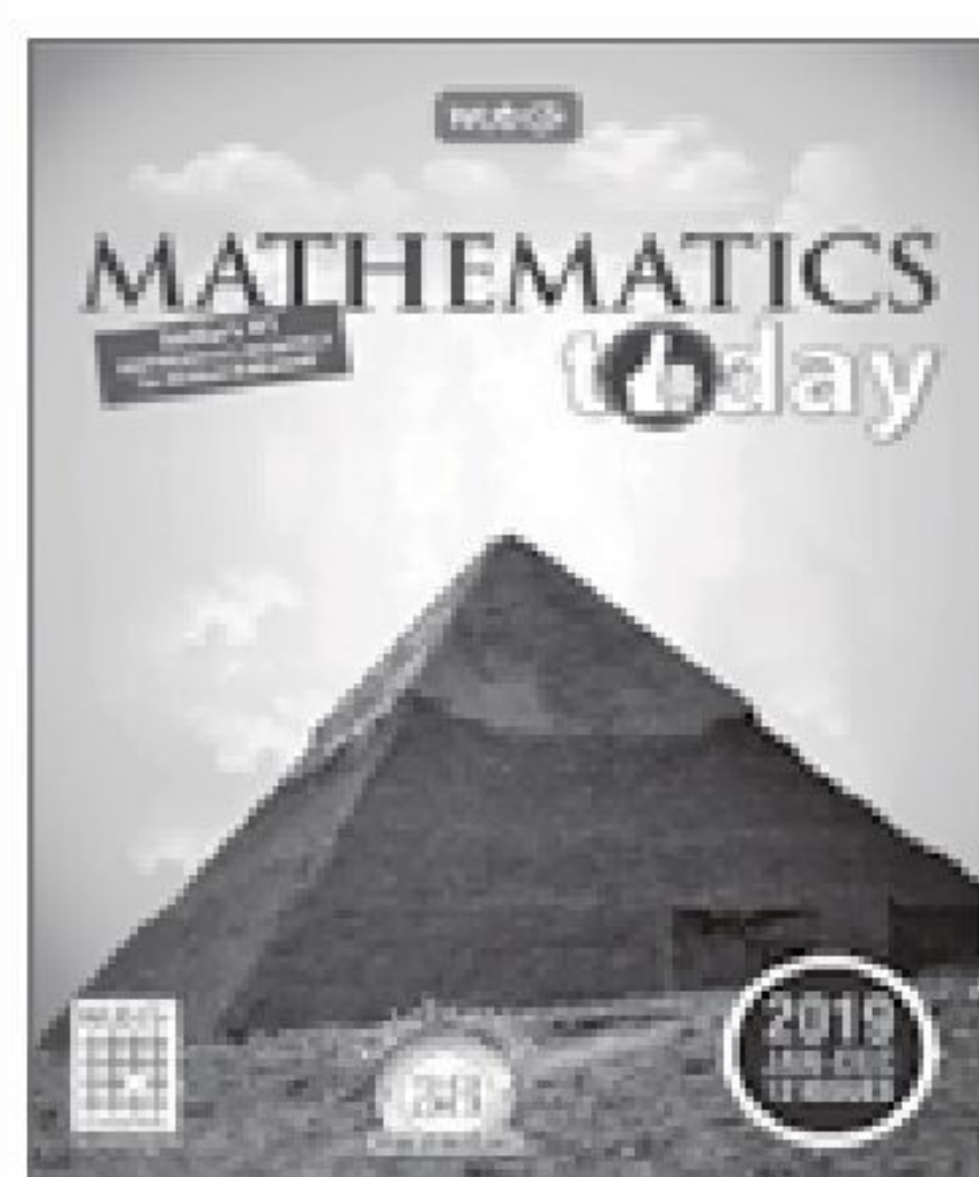
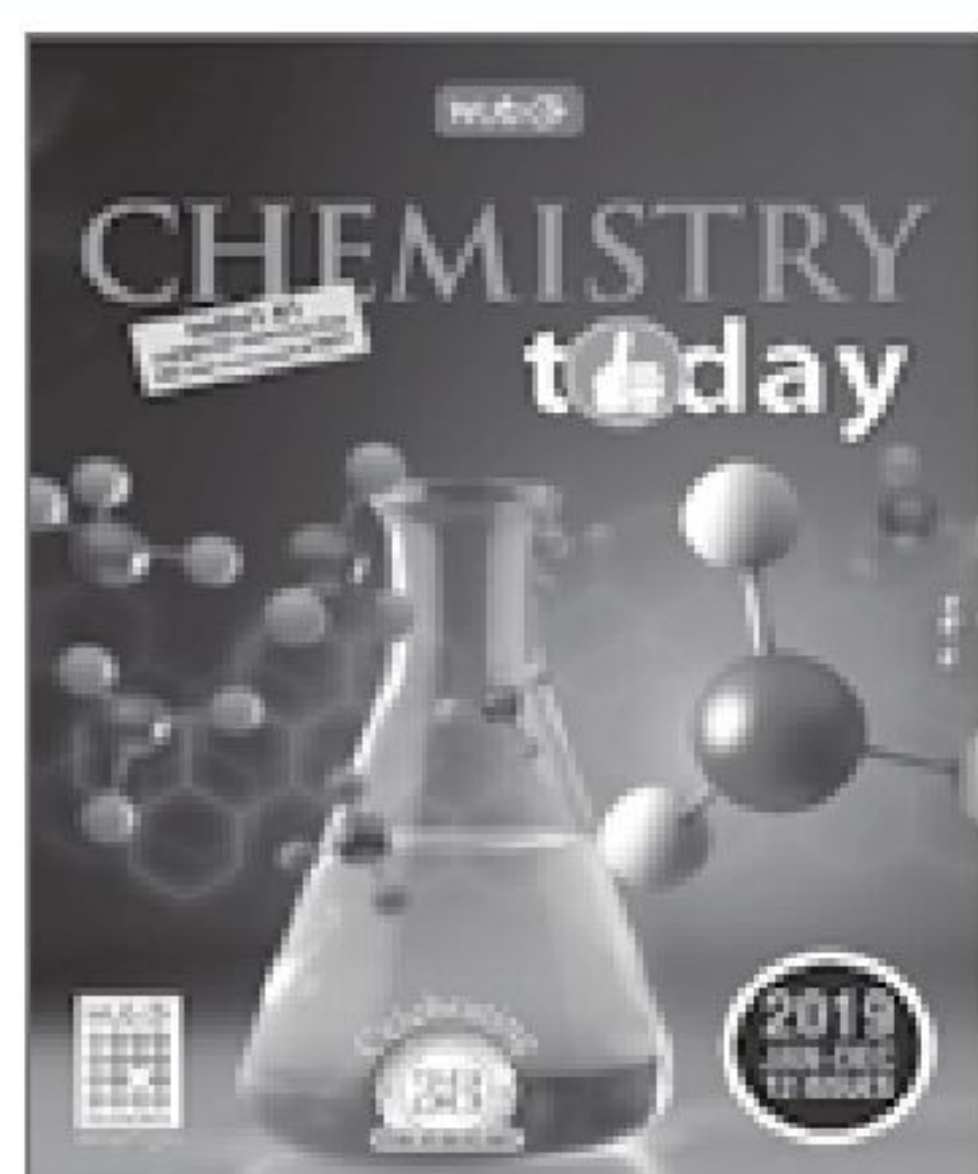
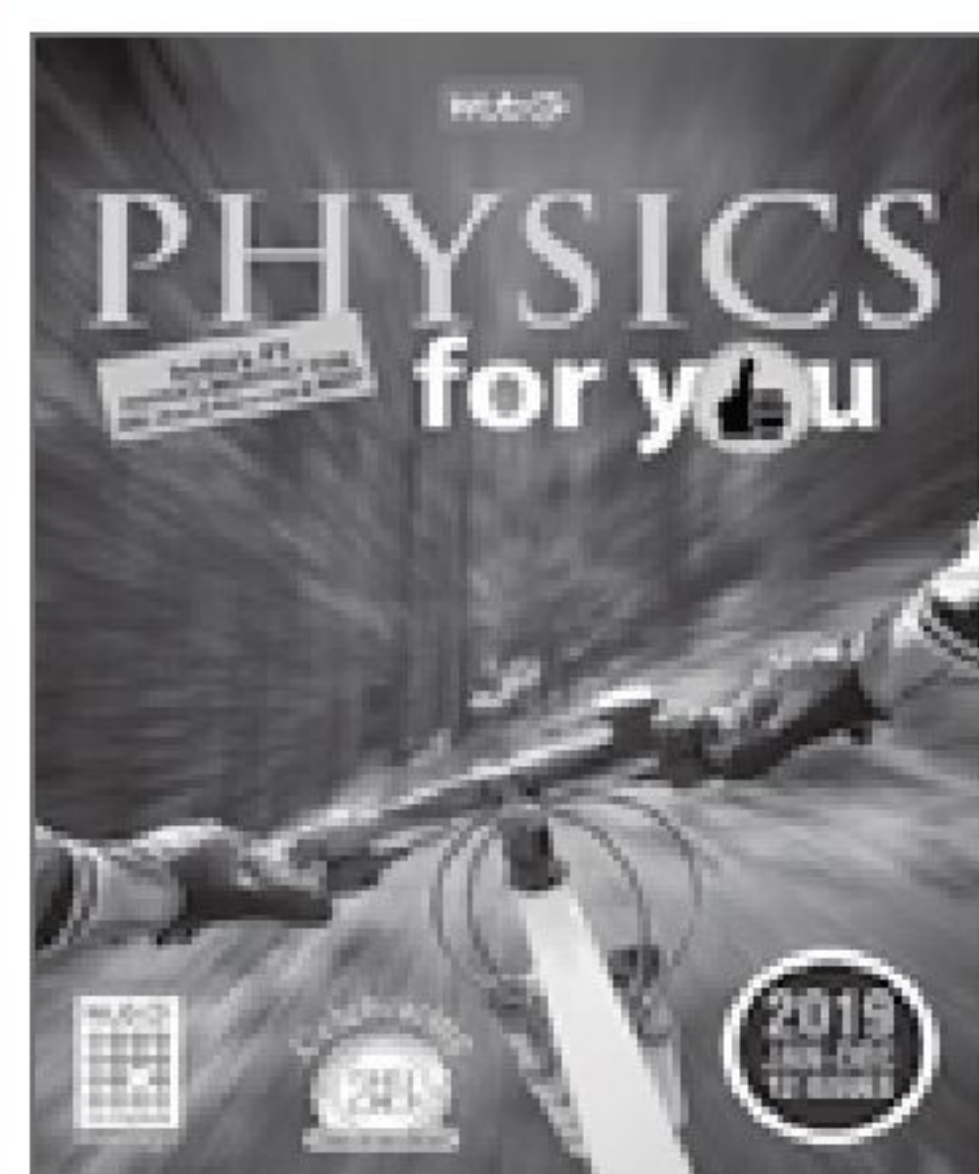
SELF CHECK

No. of questions attempted
No. of questions correct
Marks scored in percentage

Check your score! If your score is

> 90%	EXCELLENT WORK !	You are well prepared to take the challenge of final exam.
90-75%	GOOD WORK !	You can score good in the final exam.
74-60%	SATISFACTORY !	You need to score more next time.
< 60%	NOT SATISFACTORY!	Revise thoroughly and strengthen your concepts.

AVAILABLE BOUND VOLUMES



Mathematics Today 2019 (January - December)	₹ 380 12 issues
Biology Today 2019 (January - December)	₹ 380 12 issues
Physics For You 2018 (January - December)	₹ 380 12 issues
Chemistry Today 2018 (January - December)	₹ 380 12 issues
Mathematics Today 2018 (January - December)	₹ 380 12 issues
Biology Today 2018 (January - December)	₹ 380 12 issues

of your favourite magazines

How to order : Send money by demand draft/money order. Demand Draft should be drawn in favour of **MTG Learning Media (P) Ltd.** Mention the volume you require along with your name and address. OR buy online from www.mtg.in

Add ₹ 90 as postal charges

Older issues can be accessed on **digital.mtg.in** in digital form.

Mail your order to :

Circulation Manager,
MTG Learning Media (P) Ltd.
Plot No. 99, Sector 44
Institutional Area, Gurugram, (HR)
Tel.: (0124) 6601200
E-mail : info@mtg.in
Web : www.mtg.in

buy online at www.mtg.in

GET SET GO

JEE

for



with exclusive and brain storming MCQs

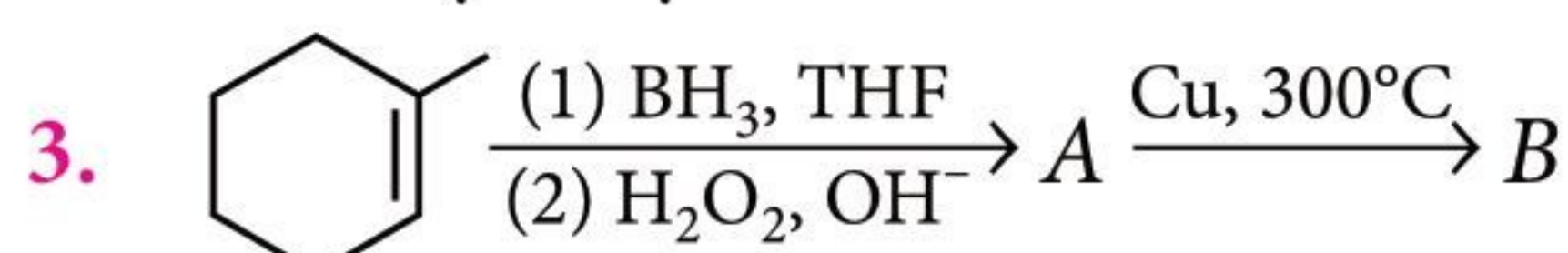
Practicing these MCQs help to strengthen your concepts and give you extra edge in your JEE preparation

1. E° values of some redox couples are given below. On the basis of these values, choose the correct option.

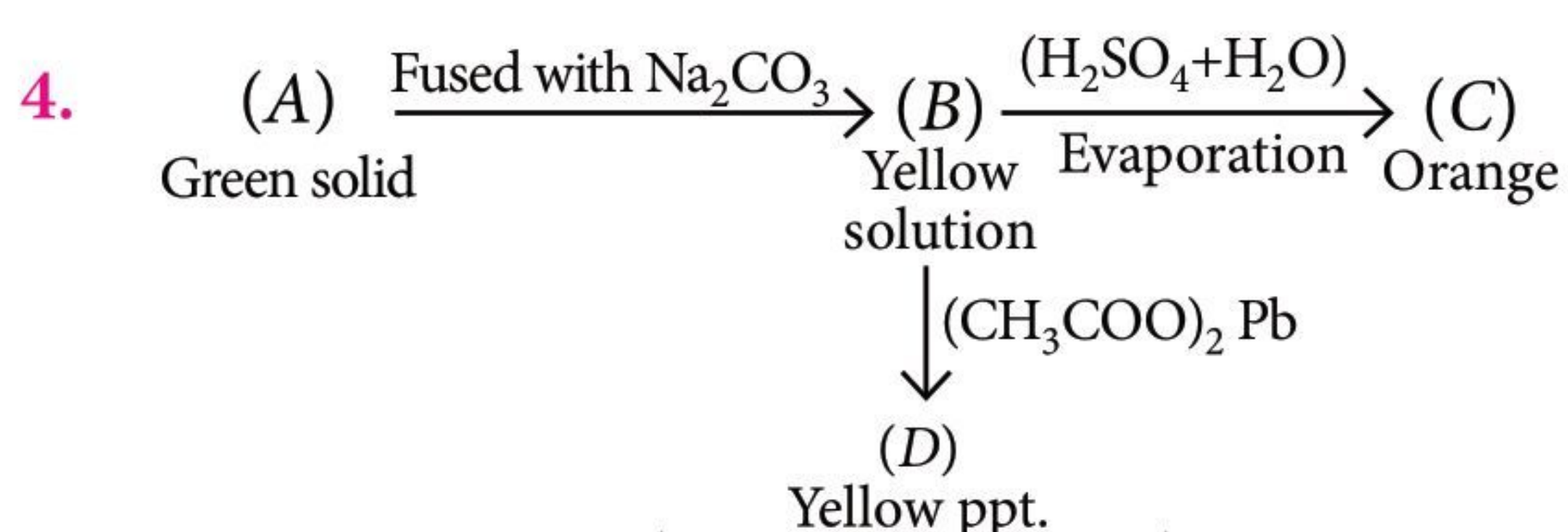
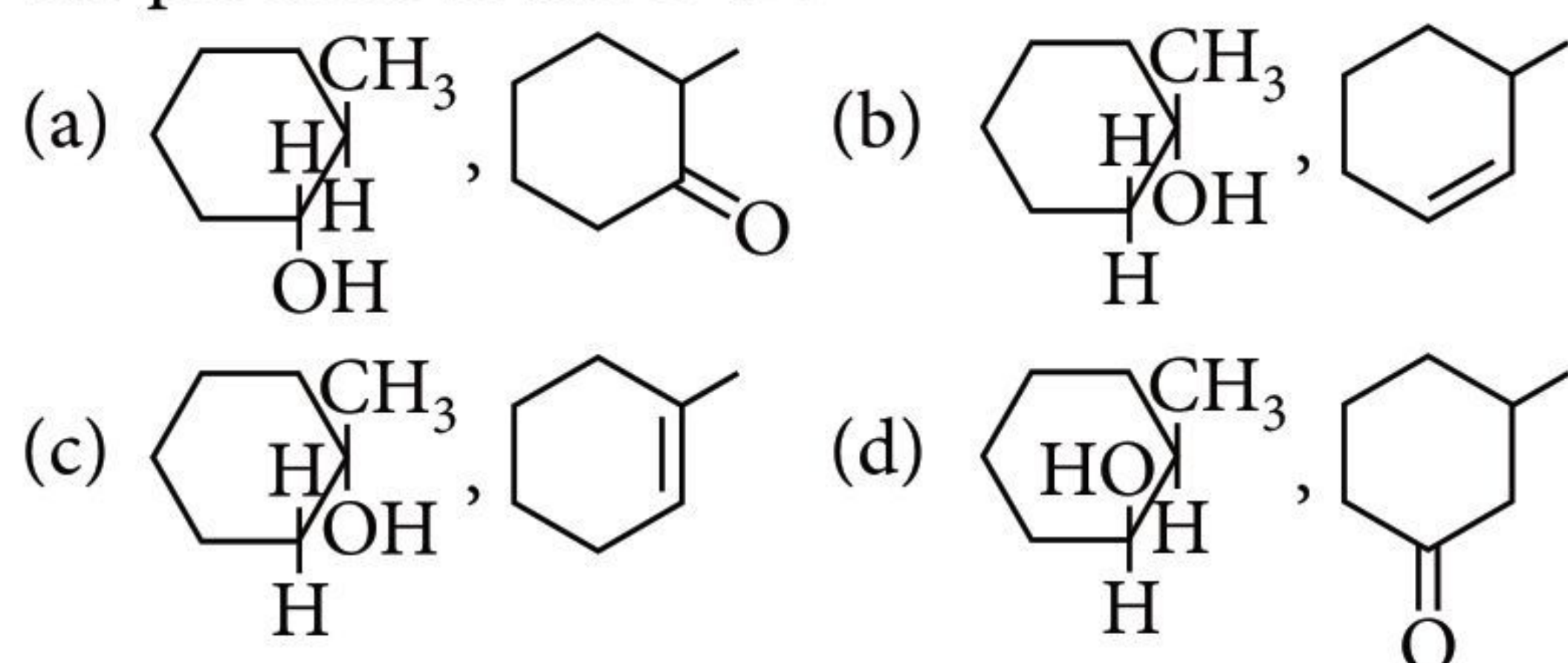
E° values : $\text{Br}_2 | \text{Br}^- = +1.90$; $\text{Ag}^+ | \text{Ag}_{(s)} = +0.80$

$\text{Cu}^{2+} | \text{Cu}_{(s)} = +0.34$; $\text{I}_{2(s)} | \text{I}^- = +0.54$

- (a) Cu will reduce Br^- . (b) Cu will reduce Ag.
(c) Cu will reduce I^- . (d) Cu will reduce Br_2 .
2. For the nitration of aniline, which of the following steps is followed?
- (a) Direct nitration using nitrating mixture (conc. HNO_3 + conc. H_2SO_4) followed by oxidation.
(b) Using fuming HNO_3 at 273 K followed by hydrolysis.
(c) Using NaNO_2 and HCl followed by reaction with conc. HNO_3 followed by hydrolysis.
(d) Acetylation followed by nitration and hydrolysis.



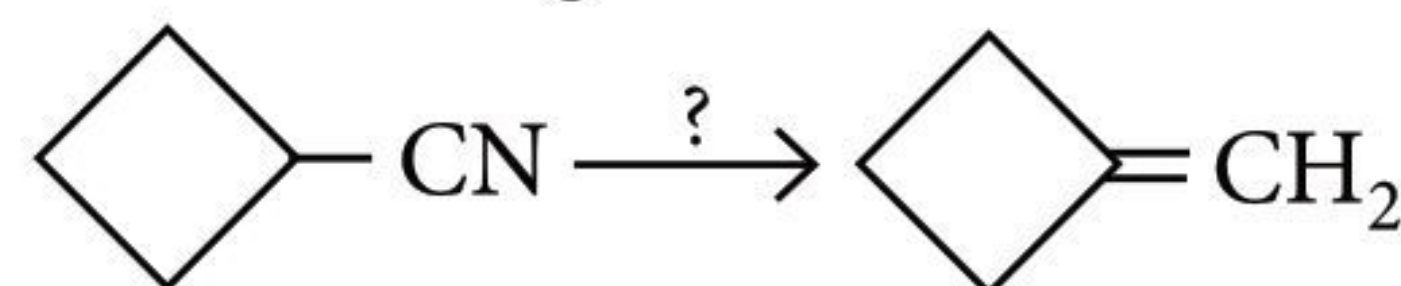
the products A and B are



Here, A, B, C and D are respectively

A	B	C	D
(a) FeSO_4	FeCO_3	$\text{Fe}(\text{OH})_3$	PbCO_3
(b) Cr_2O_3	Na_2CrO_4	$\text{Na}_2\text{Cr}_2\text{O}_7$	PbCrO_4
(c) FeCl_2	FeSO_4	PbSO_4	$\text{Fe}(\text{OH})_3$
(d) FeSO_4	FeCl_3	$\text{Fe}(\text{OH})_3$	PbCl_2

5. What sequence of reactions would best accomplish the following reaction?



- (a) (i) LiAlH_4 in ether; (ii) P_2O_5 and heat
(b) (i) LiAlH_4 in ether;
(ii) $3\text{CH}_3\text{I}$ followed by heating with AgOH
(c) (i) 20% H_2SO_4 and heat; (ii) P_2O_5 and heat
(d) H_2 and Lindlar's catalyst
6. The following complexes are given :

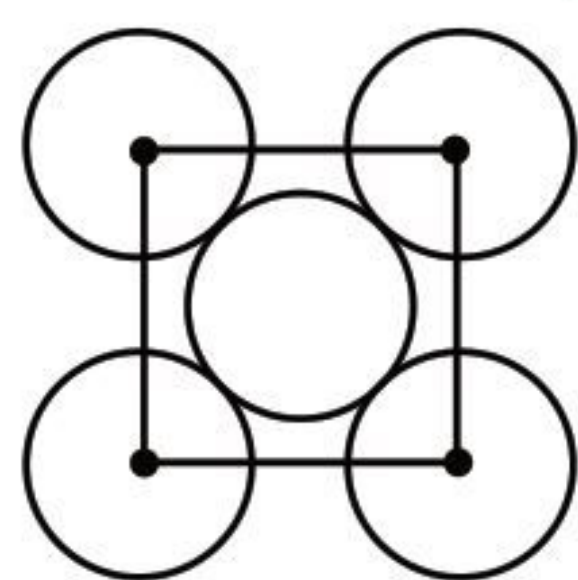
- I. $\text{trans}-[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$
II. $\text{cis}-[\text{Co}(\text{NH}_3)_2(\text{en})_2]^{3+}$
III. $\text{trans}-[\text{Co}(\text{NH}_3)_2(\text{en})_2]^{3+}$
IV. NiCl_4^{2-}



Choose the correct option.

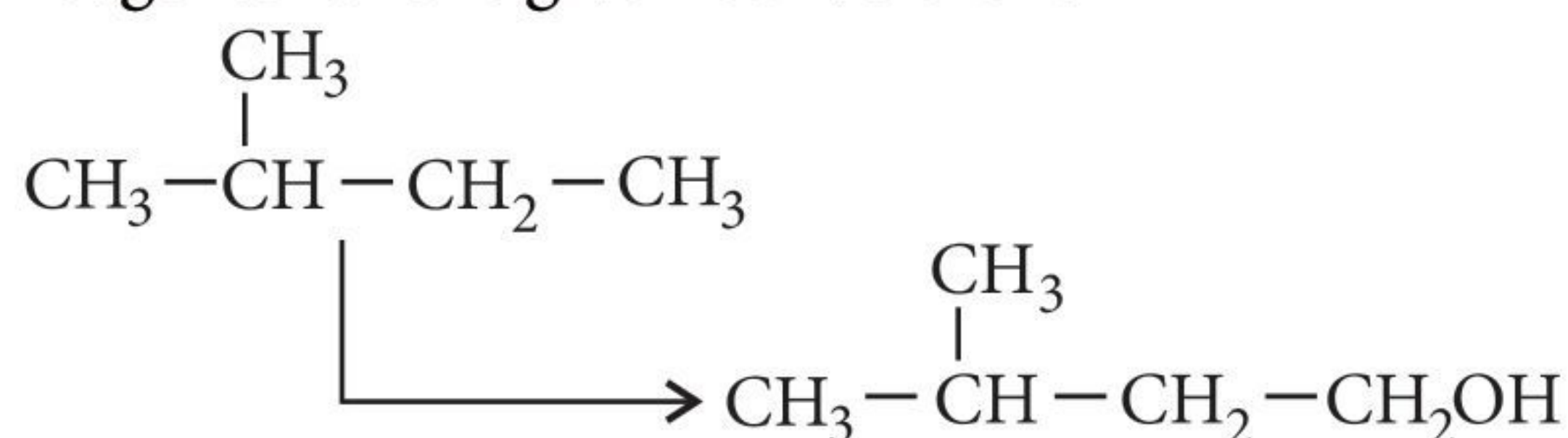
- (a) I, II are optically active, III is optically inactive.
 (b) II is optically active, I, III are optically inactive.
 (c) IV, V are coloured and VI is colourless.
 (d) IV is coloured and V, VI are colourless.

7. The packing efficiency of the two dimensional square unit cell shown in the given figure, is



- (a) 39.27% (b) 69.02%
 (c) 74.05% (d) 78.5%

8. Which of the following is the best sequence of reagents for the given conversion?



- I. $\text{Cl}_2, h\nu$: monochlorination
 II. $\text{Br}_2, h\nu$: monobromination
 III. $\text{CMe}_3\text{O}^- / \text{CMe}_3\text{OH}$
 IV. $\text{KOH}, \text{CH}_3\text{CH}_2\text{OH}, \Delta$
 V. conc. $\text{HCON}(\text{CH}_3)_2$
 VI. HCl
 VII. HBr , peroxide
 VIII. $\text{BH}_3\text{-THF}; \text{H}_2\text{O}_2, \text{OH}^-$
 (a) I, IV, VI, VII (b) I, III, VII, VIII
 (c) II, IV, VII, III, VIII (d) II, III, VII, VIII

9. Which of the following is not a correct statement?
 (a) Cassiterite, chromite and pitchblende are concentrated by hydraulic washing.
 (b) Pure Al_2O_3 is obtained from the bauxite ore by leaching in the Baeyer's process.
 (c) Sulphide ore is concentrated by calcination method.
 (d) Roasting can convert sulphide into oxide or sulphate and part of sulphide may also act as a reducing agent.

10. Applying Freundlich adsorption isotherm, calculate the amount of acetic acid adsorbed by 1 kg of blood charcoal at 25°C from a 5% vinegar solution (mass/volume). (Given that if the concentration is expressed in molarity (mol dm^{-3}), x/m is mass of the solute adsorbed per gram of adsorbent, then $k = 0.160$ and $n = 2.32$.)

- (a) 147.8 (b) 150.2
 (c) 158.1 (d) 140.2

11. For 'invert sugar', the incorrect statement(s) is(are) (Given : specific rotations of (+)-sucrose, (+)-maltose, L -(-)-glucose and L -(+)-fructose in aqueous solution are $+66^\circ$, $+140^\circ$, -52° and $+92^\circ$, respectively)
 (I) 'invert sugar' is prepared by acid catalyzed hydrolysis of maltose
 (II) 'invert sugar' is an equimolar mixture of D -(+)-glucose and D -(-)-fructose
 (III) specific rotation of 'invert sugar' is -20°
 (IV) on reaction with Br_2 water, 'invert sugar' forms saccharic acid as one of the product.
 (a) II and III (b) I and II
 (c) I and IV (d) I, II and IV

12. Which of the following is a characteristic of low density polyethylene (LDPE)?
 (a) Low density polyethylene is stronger and stiffer than high density polyethylene but its impact strength is not so good at low temperature.
 (b) Low density polyethylene consists primarily of unbranched molecules with very few flaws to mar its linearity.
 (c) With extremely low levels of defects to hinder organization, a high degree of crystallinity can be achieved.
 (d) Low density polyethylene contains substantial concentrations of branches that hinder crystallisation.

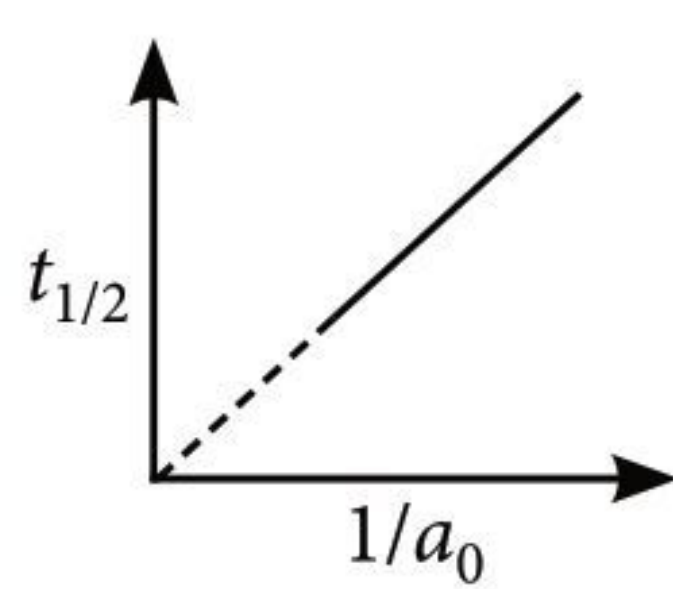
NUMERICAL PROBLEMS

13. At 143 K, the reaction of XeF_4 with O_2F_2 produces a xenon compound Y. The total number of lone pair(s) of electrons present in the whole molecule of Y is _____.

MONTHLY TEST DRIVE CLASS XI ANSWER KEY

- | | | | | |
|-----------|-------------|-------------|---------|------------|
| 1. (b) | 2. (a) | 3. (d) | 4. (c) | 5. (a) |
| 6. (a) | 7. (a) | 8. (d) | 9. (b) | 10. (b) |
| 11. (d) | 12. (d) | 13. (c) | 14. (c) | 15. (a) |
| 16. (b) | 17. (c) | 18. (c) | 19. (c) | 20. (c,d) |
| 21. (b,c) | 22. (a,b,d) | 23. (a,b,c) | 24. (6) | 25. (7.09) |
| 26. (5) | 27. (b) | 28. (d) | 29. (c) | 30. (a) |

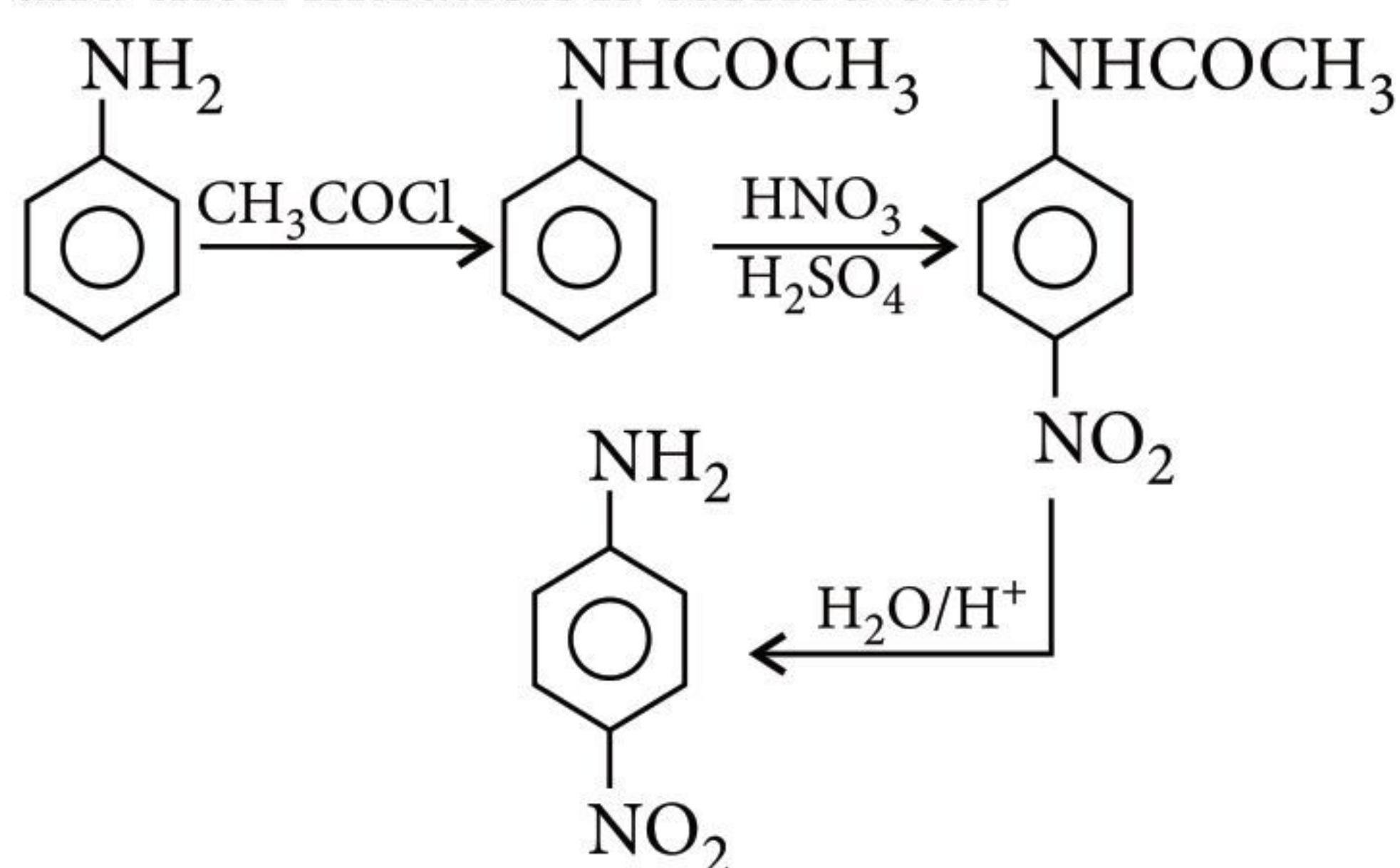
14. The following graph shows how $t_{1/2}$ (half-life) of a reactant R changes with the initial reactant concentration a_0 . The order of the reaction will be _____.



15. The degree of dissociation of $\text{Ca}(\text{NO}_3)_2$ in dilute aqueous solution containing 7 g of salt per 100 g of water at 100°C is 70%. If the vapour pressure of water at 100°C is 760 mm Hg, the vapour pressure of the solution is _____ mmHg.

SOLUTIONS

1. (d): Cu will reduce Br_2 and not Br^- .
 2. (d): $-\text{NH}_2$ group is oxidised on direct nitration hence $-\text{NH}_2$ group is first protected by acetylation and then nitration is carried out.

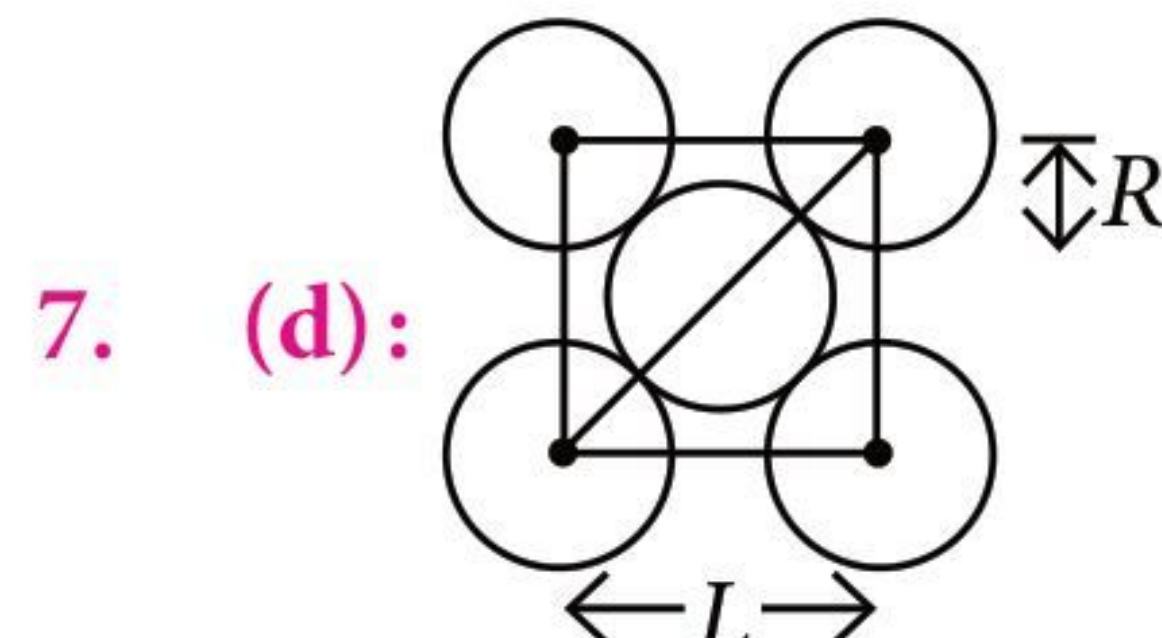


3. (a):

4. (b): $2\text{Cr}_2\text{O}_3 + 3\text{O}_2 + 4\text{Na}_2\text{CO}_3 \rightarrow 4\text{Na}_2\text{CrO}_4 + 4\text{CO}_2$ (A) (B)
 $2\text{Na}_2\text{CrO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{Cr}_2\text{O}_7 + \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$ (C)
 $\text{Na}_2\text{CrO}_4 + \text{Pb}(\text{CH}_3\text{COO})_2 \rightarrow \text{PbCrO}_4 + 2\text{CH}_3\text{COONa}$ (D)

5. (b):

6. (b): $\text{trans}-[\text{MA}_4\text{B}_2]$ and $\text{trans}-[\text{M}(\text{AA})_2\text{B}_2]$ type complexes are optically inactive whereas $\text{cis}-[\text{M}(\text{AA})_2\text{B}_2]$ type complex are optically active. NiCl_4^{2-} and CoF_6^{3-} are coloured whereas TiF_6^{2-} is colourless.



$$4R = L\sqrt{2}$$

$$\text{so, } L = 2\sqrt{2}R$$

$$\text{Area of square unit cell} = (2\sqrt{2}R)^2 = 8R^2$$

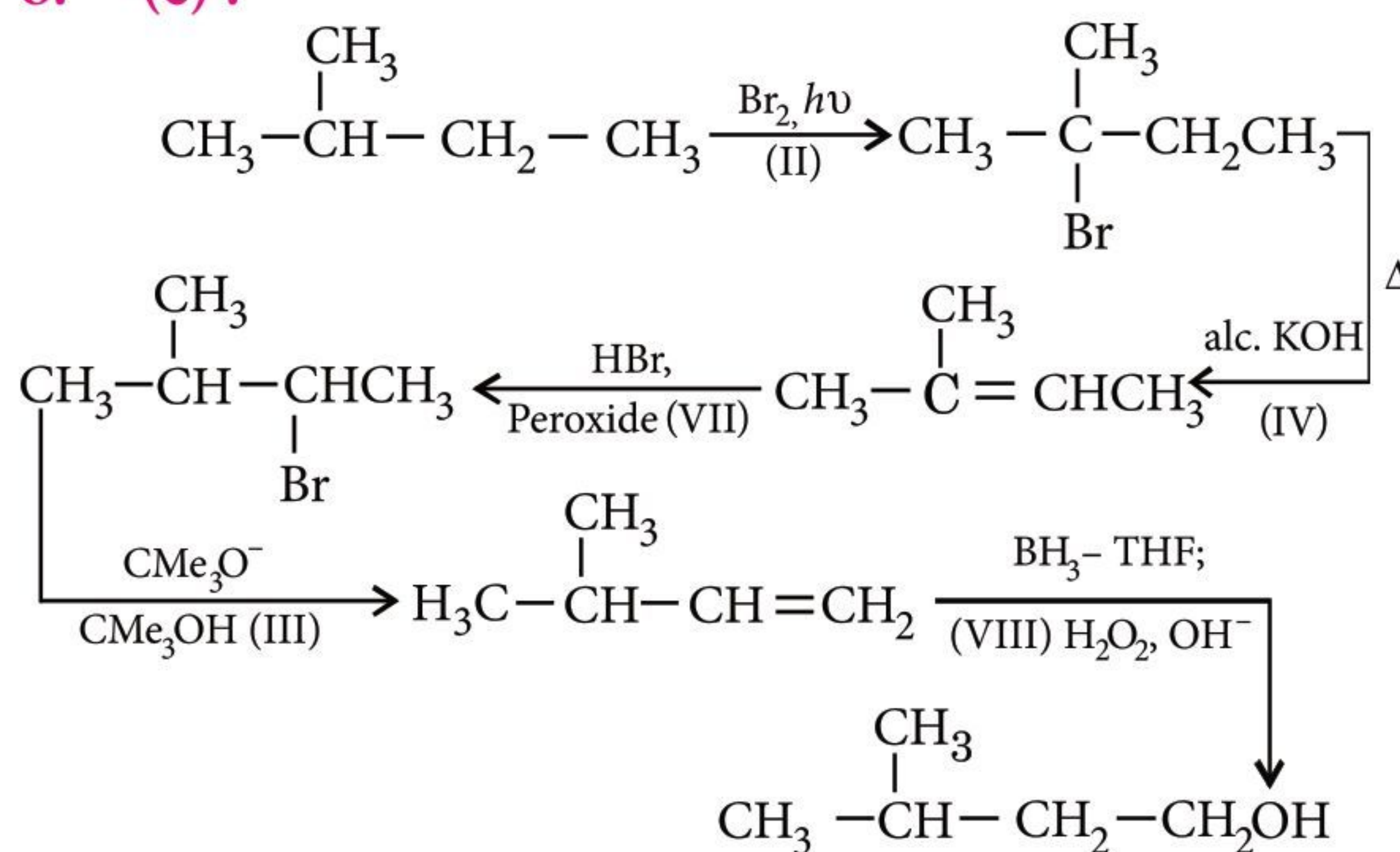
Area of atoms present in one unit cell

$$= \pi R^2 + 4\left(\frac{\pi R^2}{4}\right) = 2\pi R^2$$

$$\text{so, packing efficiency} = \frac{2\pi R^2}{8R^2} \times 100$$

$$= \frac{\pi}{4} \times 100 = 78.5\%$$

8. (c):



9. (c): Sulphide ores are concentrated by froth flotation method.

10. (a): According to Freundlich adsorption isotherm, $\frac{x}{m} = kC^{1/n}$... (i)

5% vinegar (acetic acid solution) means 5 g of acetic acid are present in 100 mL of the solution.

Molar mass of acetic acid (CH_3COOH) = 60 g mol^{-1}

$$\therefore 5 \text{ g of acetic acid} = \frac{5}{60} \text{ mol}$$

$$\text{Concentration of the solution (C)} = \frac{5}{60} \times \frac{1}{100} \times 1000 = 0.833 \text{ mol L}^{-1}$$

$$\text{i.e., } \frac{x}{m} = 0.160 \times (0.833)^{1/2.32}$$

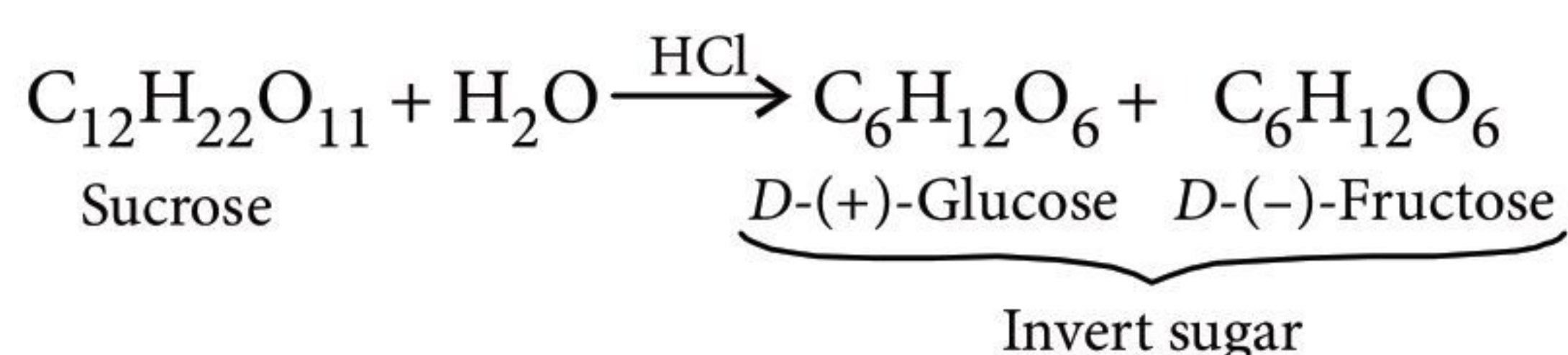
$$\therefore \log \frac{x}{m} = \log(0.160) + \frac{1}{2.32} \log(0.833)$$

$$= -0.7959 + 0.431(-0.0794) = -0.8301$$

$$\therefore \frac{x}{m} = \text{Antilog}(-0.8301) = 0.1478 \text{ g}$$

\therefore Amount adsorbed by 1 kg (1000 g) of charcoal = 147.8 g

11. (c) : Invert sugar is prepared by acid catalyzed hydrolysis of sucrose.

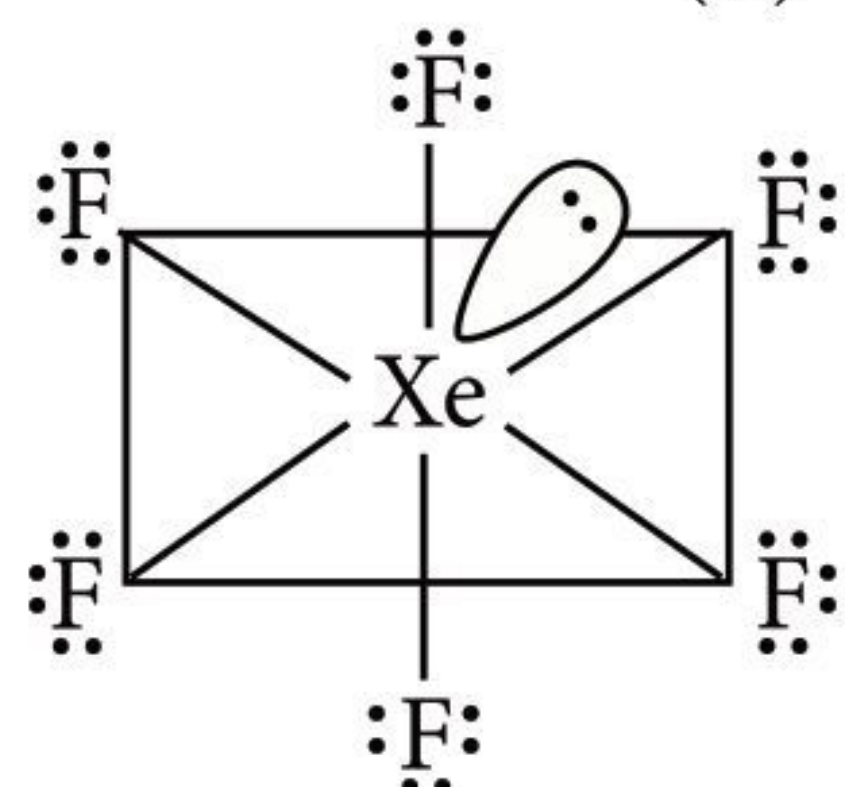
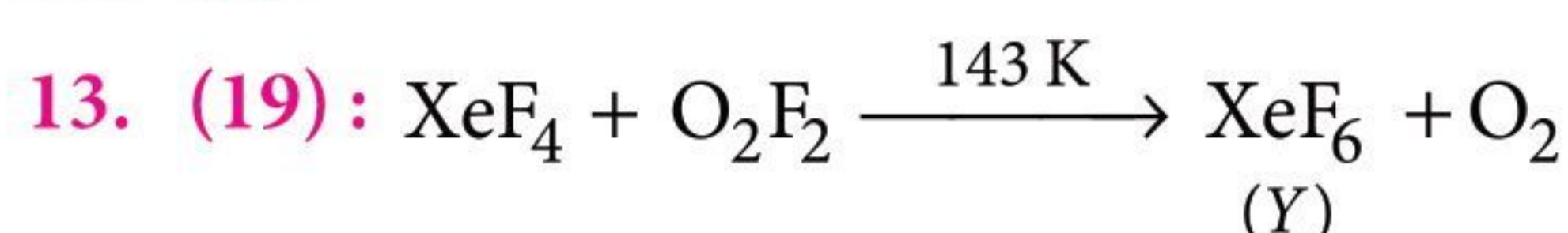


Specific rotation of invert sugar is

$$[\alpha]_{\text{mix}} = 0.5 \times (+52) + 0.5 \times (-92) = +26 - 46 = -20^\circ$$

On reaction with Br_2 water, invert sugar forms gluconic acid as one of the products. Br_2 water oxidises glucose into gluconic acid and fructose is not oxidised by it.

12. (d)



In structure of XeF_6 , one lone pair on Xe atom, three lone pairs on each F atom are present.

Thus, total 19 lone pairs of electrons are present on molecule Y.

14. (2) : Half life is inversely proportional to initial concentration of reactants for second order reaction.

15. (747.93) : Number of moles of $\text{Ca}(\text{NO}_3)_2$ present in 100 g of water = $\frac{7}{164}$

Since dissociation is 70%, the total number of particles, $n = \frac{7}{164} \times 0.7 \times 3 = 0.0896$

Also, number of moles of solvent, $N = \frac{100}{18} = 5.55$

Applying Raoult's law,

$$\frac{p^\circ - p_{\text{solution}}}{p^\circ} = \frac{n}{n+N} \text{ or } \frac{760 - p_s}{760} = \frac{0.0896}{0.0896 + 5.55}$$

$$\text{or } 760 - p_s = 760 \left(\frac{0.0896}{5.6396} \right)$$

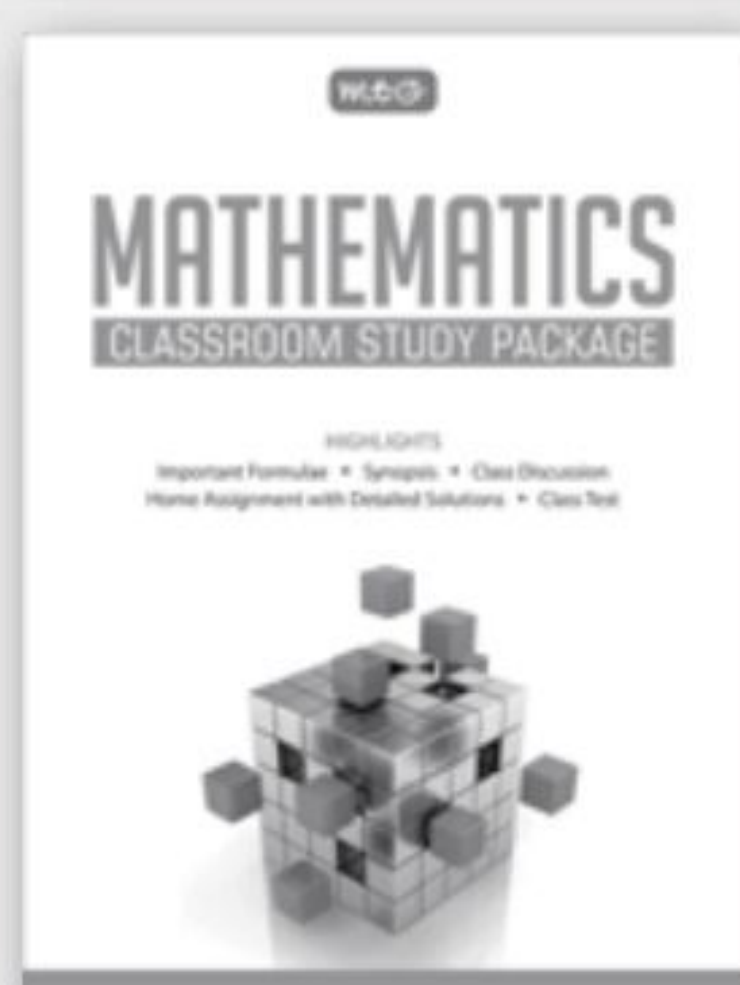
$$= 760(0.0158) = 12.07$$

$$\text{or } p_s = 760 - 12.07 = 747.93 \text{ mm Hg}$$



ATTENTION
COACHING
INSTITUTES :
a great offer from
MTG

CLASSROOM STUDY MATERIAL



MTG offers "Classroom Study Material" for JEE (Main & Advanced), NEET and FOUNDATION MATERIAL for Class 6, 7, 8, 9, 10, 11 & 12 with **YOUR BRAND NAME & COVER DESIGN**.

This study material will save your lots of money spent on teachers, typing, proof-reading and printing. Also, you will save enormous time. Normally, a good study material takes 2 years to develop. But you can have the material printed with your logo delivered at your doorstep.

Profit from associating with MTG Brand – the most popular name in educational publishing for JEE (Main & Advanced)/NEET

Order sample chapters on Phone/Fax/e-mail.

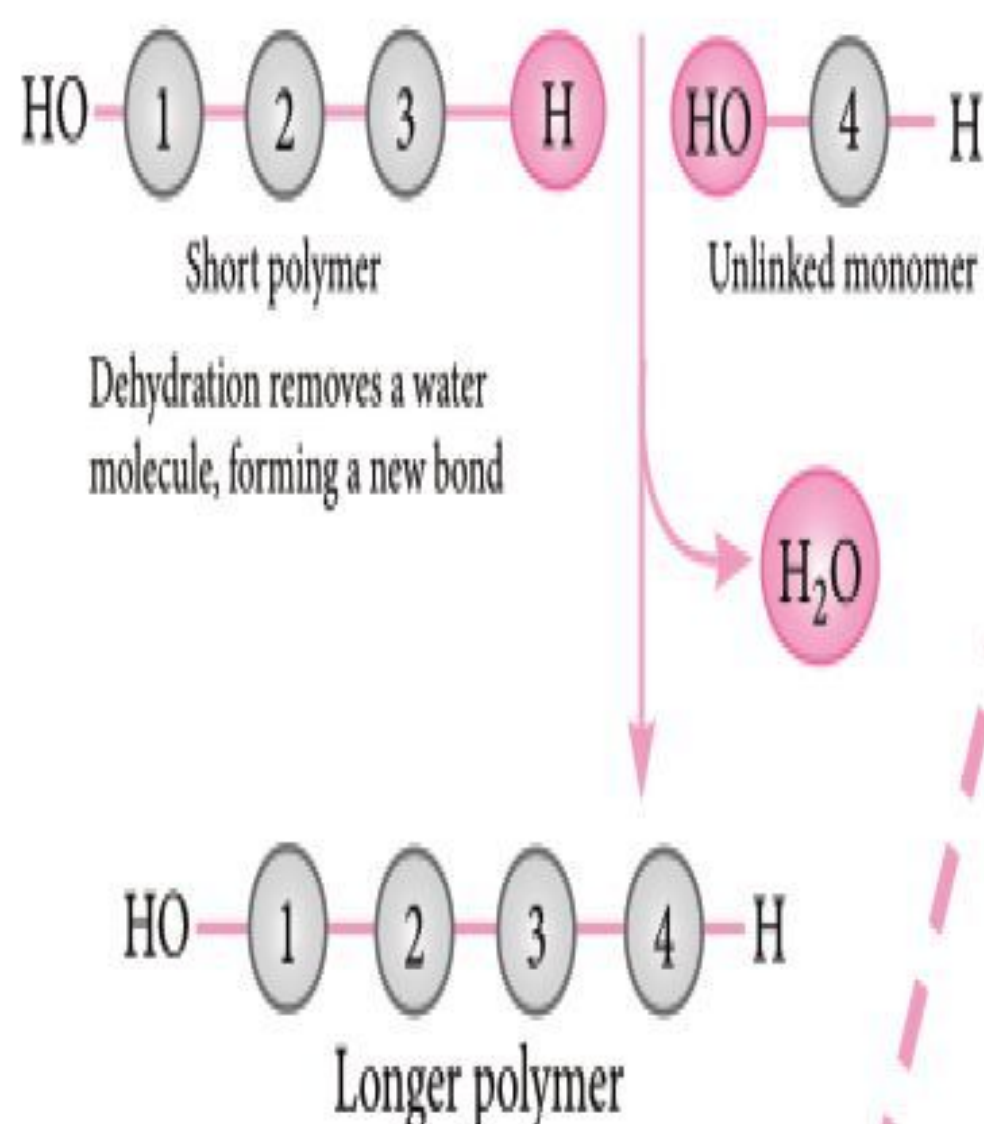
Phone : 0124-6601200 | 09312680856

e-mail : sales@mtg.in | www.mtg.in



CONCEPT MAP

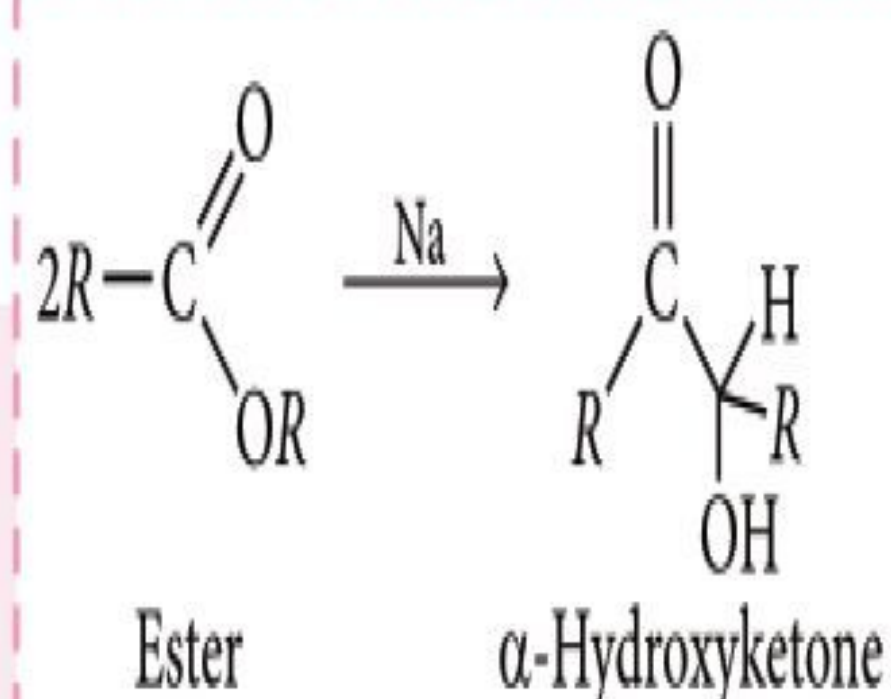
CONDENSATION REACTIONS



Acyloin Condensation

Acyloins belong to the class of α -hydroxyketones. In absence of proton source, esters undergo bimolecular reduction when reacted with sodium.

Reaction is carried out by refluxing the reactants in aprotic solvents such as ether, benzene, etc. The reaction is most successful when R is alkyl.

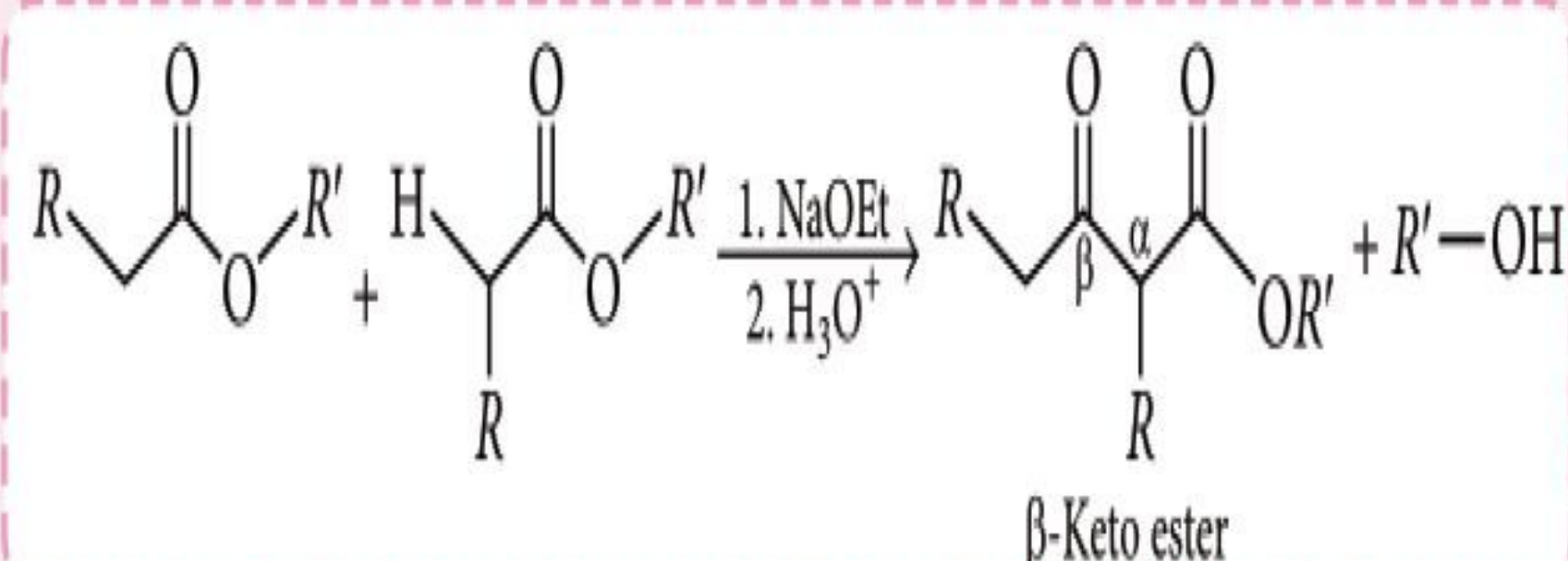


Aldol Condensation

The addition reaction of enol or enolate to the carbonyl group of aldehydes or ketones is known as aldol (aldehyde + alcohol) addition. The β -hydroxyaldehyde and the β -hydroxyketone so obtained undergo dehydration in the second step to produce a conjugated enone. The first part of the reaction is an addition reaction and the second part is an elimination reaction. Aldol condensation is seen in case of carbonyl compounds containing α -hydrogens. Dilute bases such as NaOH, KOH, Ba(OH)₂, etc. are used as reagents. Aldol condensations are also catalysed by acids.

Claisen Condensation

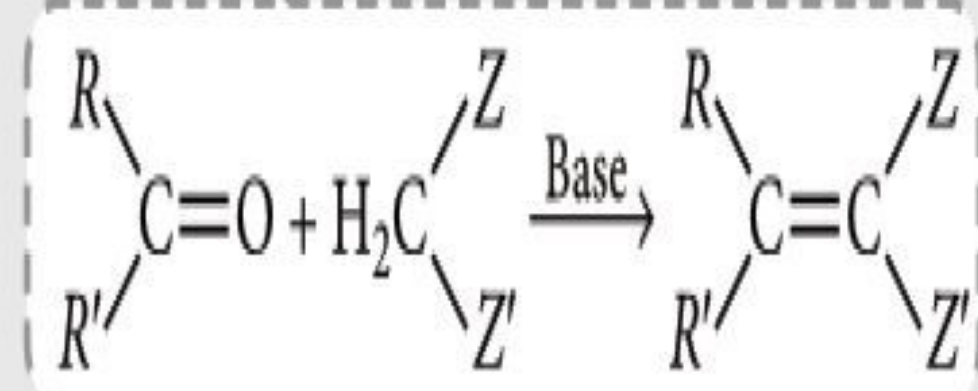
The Claisen condensation is a carbon-carbon bond forming reaction between two esters or one ester and another carbonyl compound in presence of a strong base. The product is a β -keto ester or a β -diketone.



Though sodium ethoxide is commonly used as base, strong bases such as NaH, NaNH₂ or KH often increase the yield.

Knoevenagel Condensation

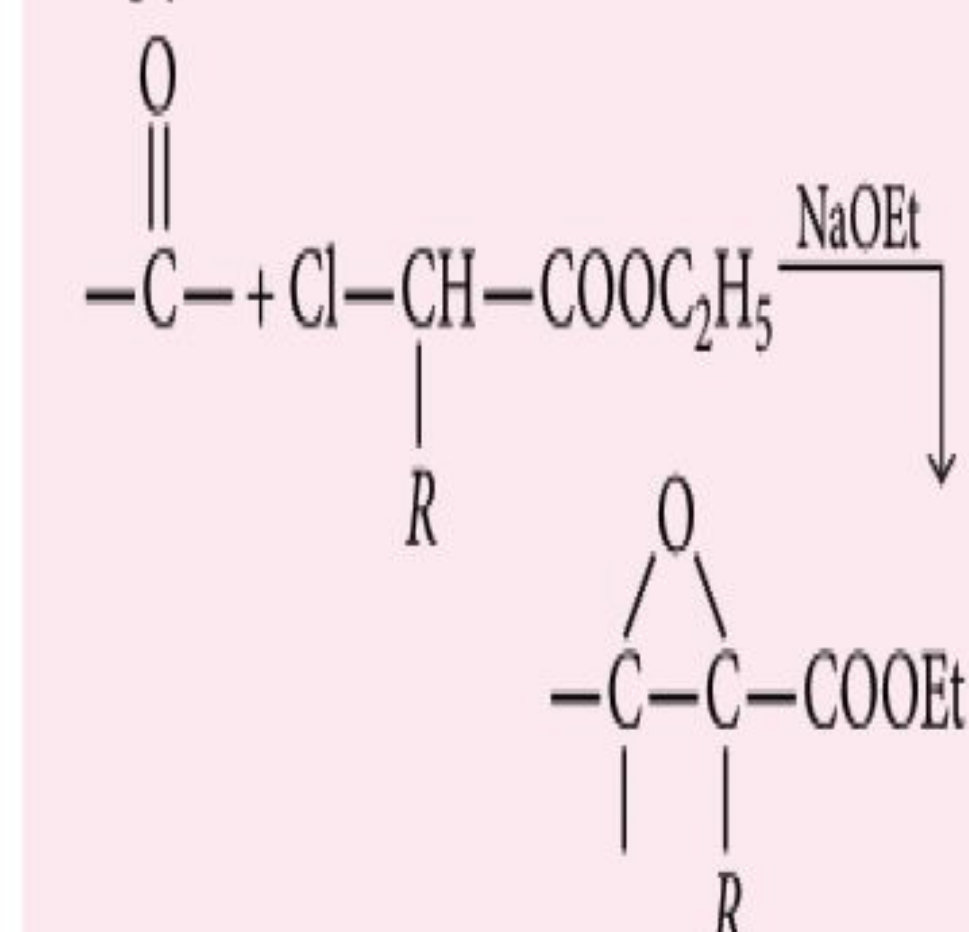
Compounds containing active hydrogens condense with aldehydes or ketones in a reaction known as Knoevenagel condensation.



Z₁ = Z' = CO₂R, COR, CHO, CN, NO₂, etc.

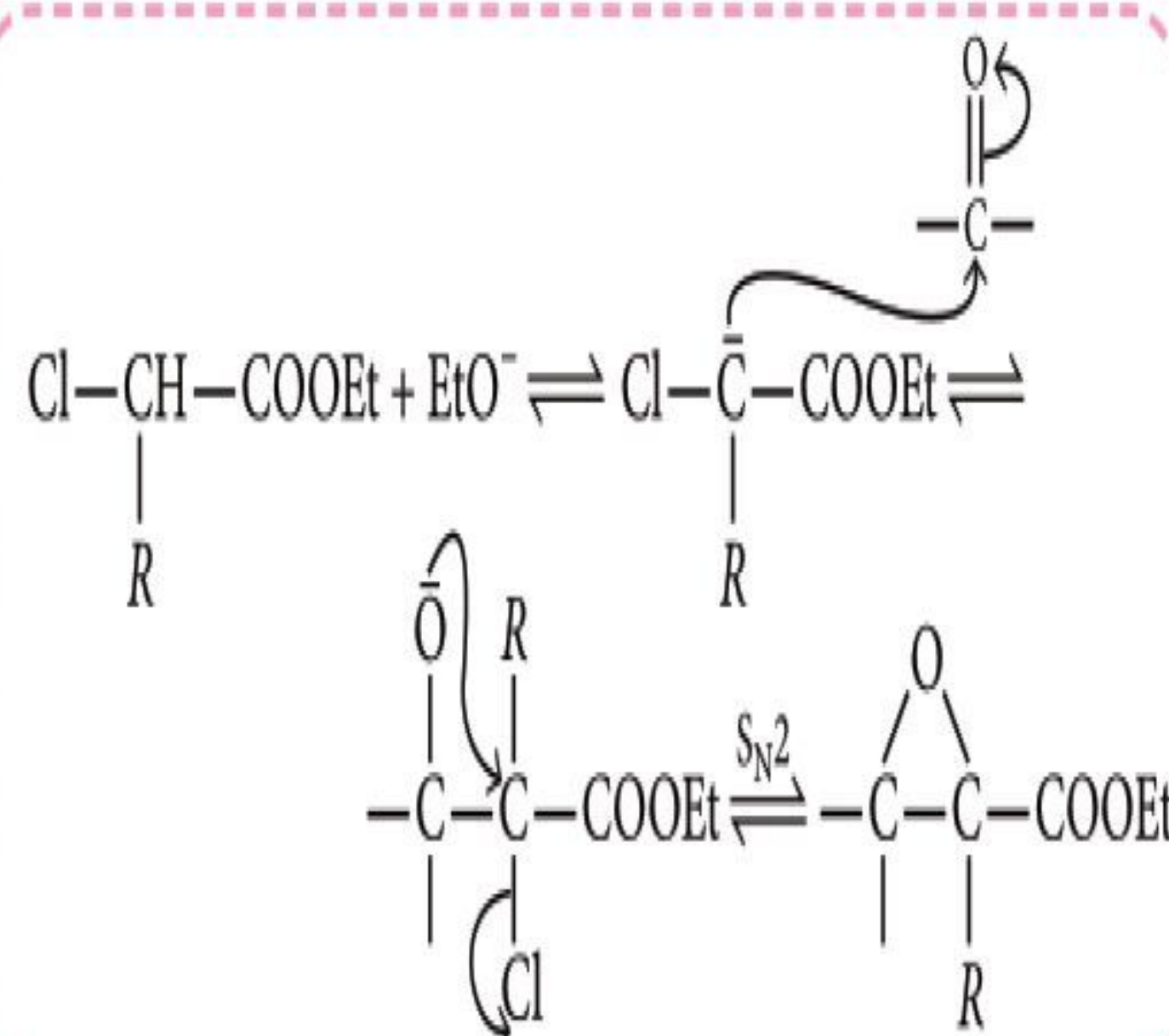
Darzens Condensation

The condensation of aldehyde or ketone with an α -halo ester to produce an α , β -epoxy ester or a glycidic ester is the Darzens condensation.

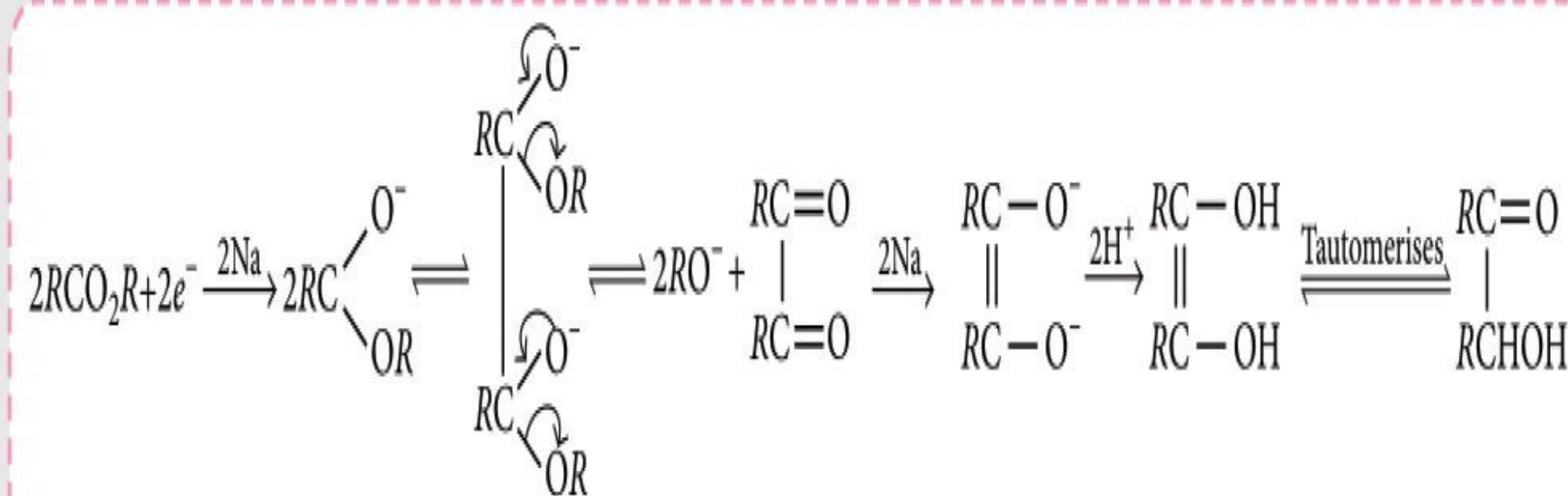


Mechanism

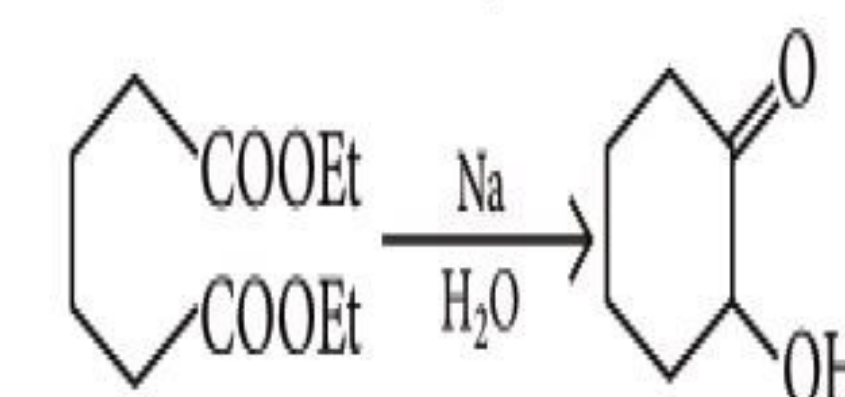
The mechanism involves the formation of an enolate. The enolate then attacks the carbonyl group to form a halo-alkoxide ion. The next step is an intramolecular S_N2 reaction, an example of Neighbouring Group Participation (NGP). The reaction follows third order kinetics.



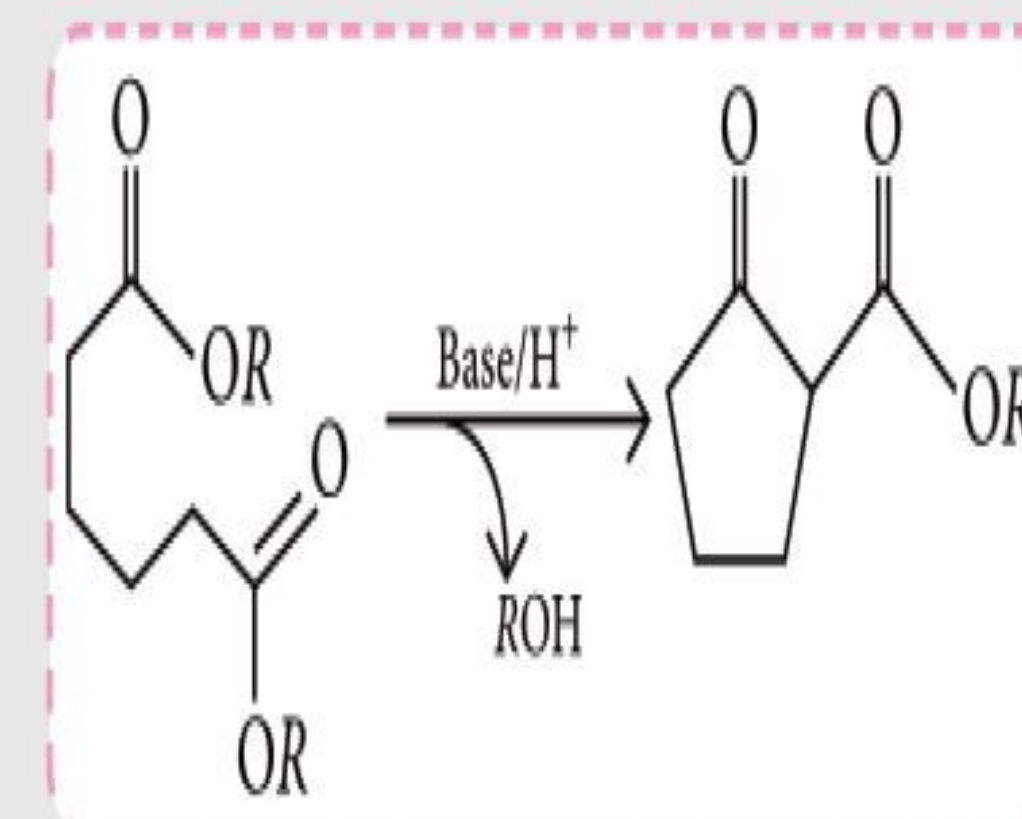
Mechanism



The acyloin condensation of diesters favours intramolecular cyclisation over intermolecular polymerisation.

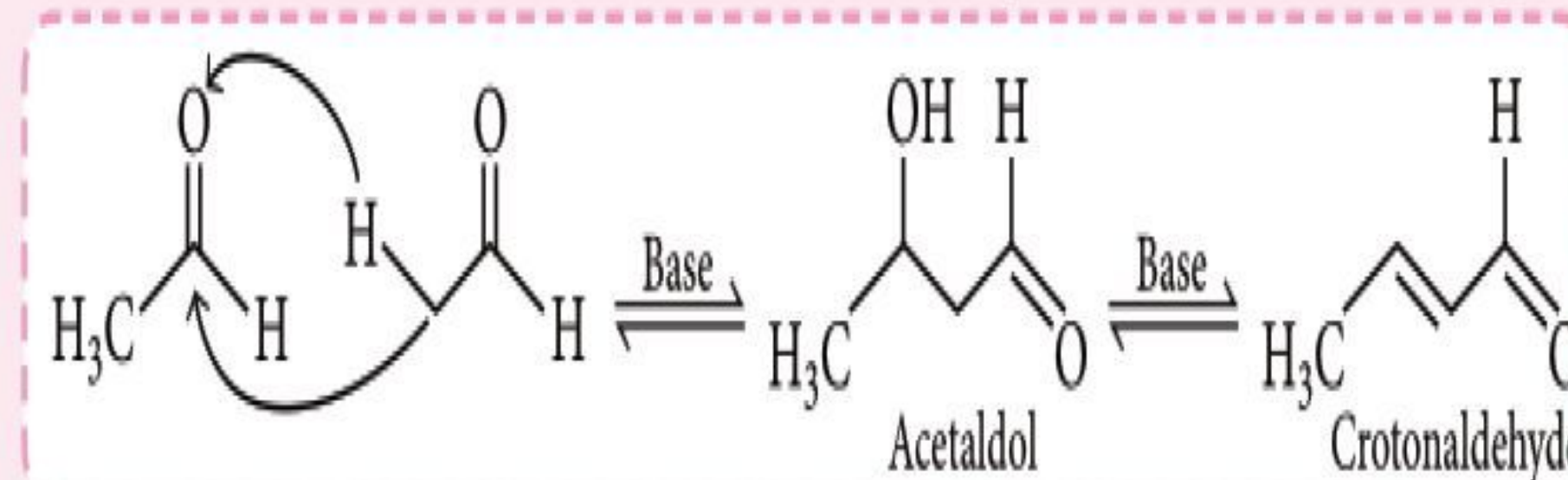


Dieckmann condensation (Intramolecular Claisen Condensation in dibasic acid esters) competes with acyloin condensation, particularly during the synthesis of 5, 6 or 7 membered rings. However, this can be prevented by using chlorotrimethylsilane (Me₃SiCl) instead of Na.



Simple Aldol Condensation

Base catalysed : Aldol condensation between two molecules of same aldehyde or ketone is called simple aldol condensation.



The aldol undergoes dehydration to give a stable conjugated aldehyde. Now the reaction can be designated as aldol condensation, as two molecules have united with the elimination of a water molecule.

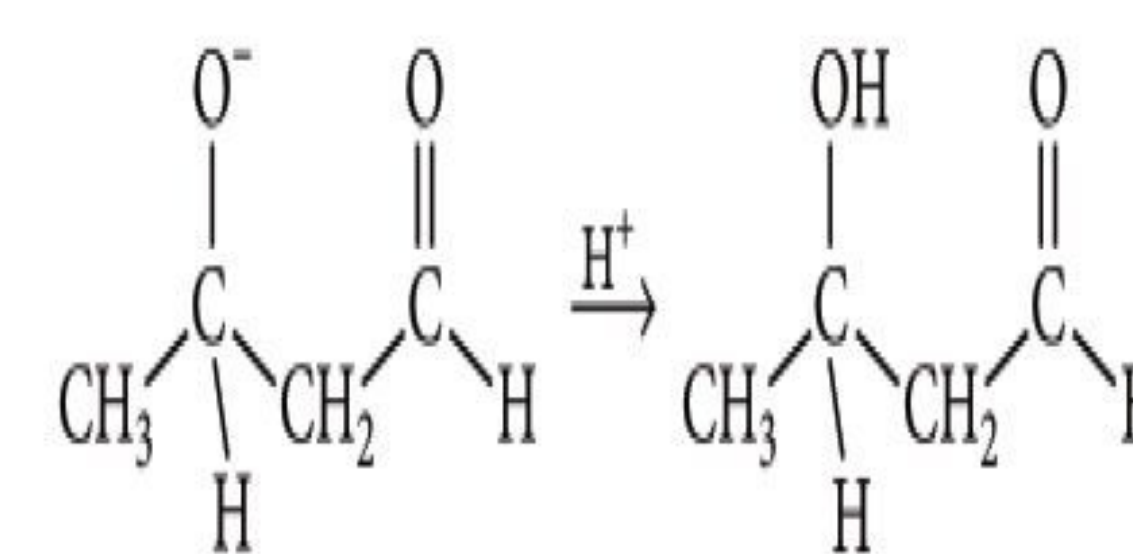
Base catalysed dehydration follows E1cB mechanism, whereas acid catalysed dehydration follows E1 mechanism.

Comparison with Aldol Condensation

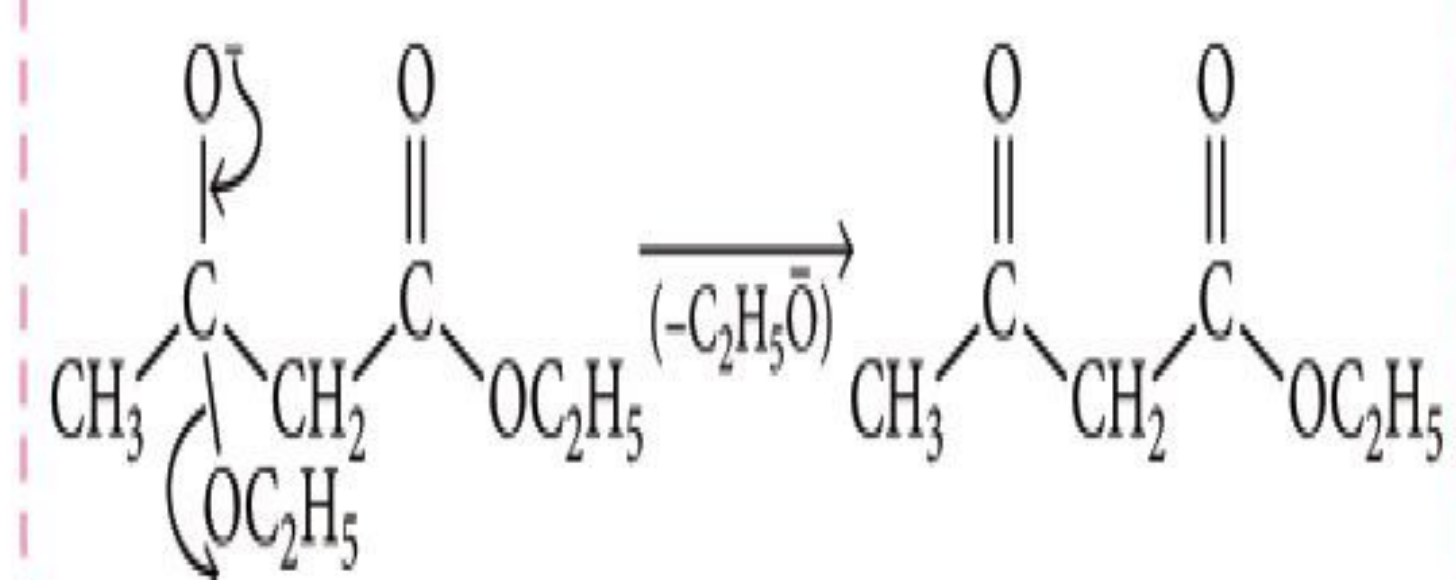
In the first step, we have an impressive difference as well as a remarkable similarity. Claisen condensation uses an alkoxide as base rather than hydroxide in aldol condensation. Hydroxide would hydrolyse the ester. However, there is also a notable similarity here, both generate enolate.

The enolates then attack their respective substrates, both reactions now going in a very similar way. Next is the turn for the real difference. The dimer from aldol condensation gets protonated, whereas that obtained from ester rejects ethoxide ion to complete the addition-elimination sequence.

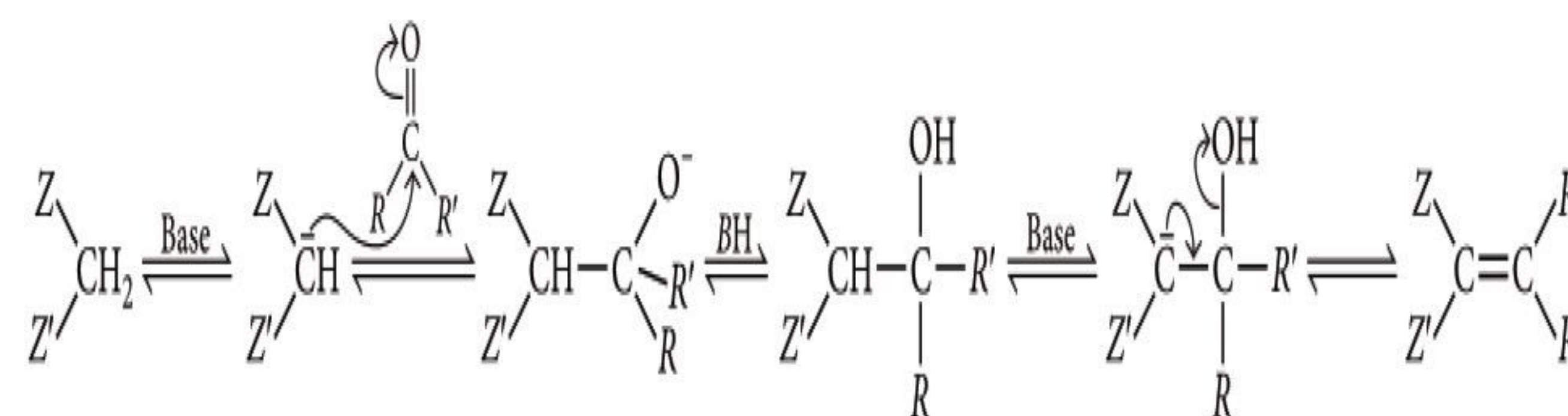
Aldol Condensation :



Claisen Condensation :



Mechanism



Applications of Condensation Reactions

- Condensation reactions are mainly used for organic synthesis.
- Condensation reactions are also very important in biological synthesis like, glycosylation, phosphorylation, polypeptide and polynucleotide synthesis.
- Condensation reactions are also very important in polymer industry for example in preparation of nylon, dacron, etc.

BRUSH UP ^{for} NEET/JEE

CLASS-XII

Brush up your concepts to get high rank in NEET/JEE (Main and Advanced) by reading this column. This specially designed column is updated year after year by a panel of highly qualified teaching experts well-tuned to the requirements of these Entrance Tests.

Unit
6

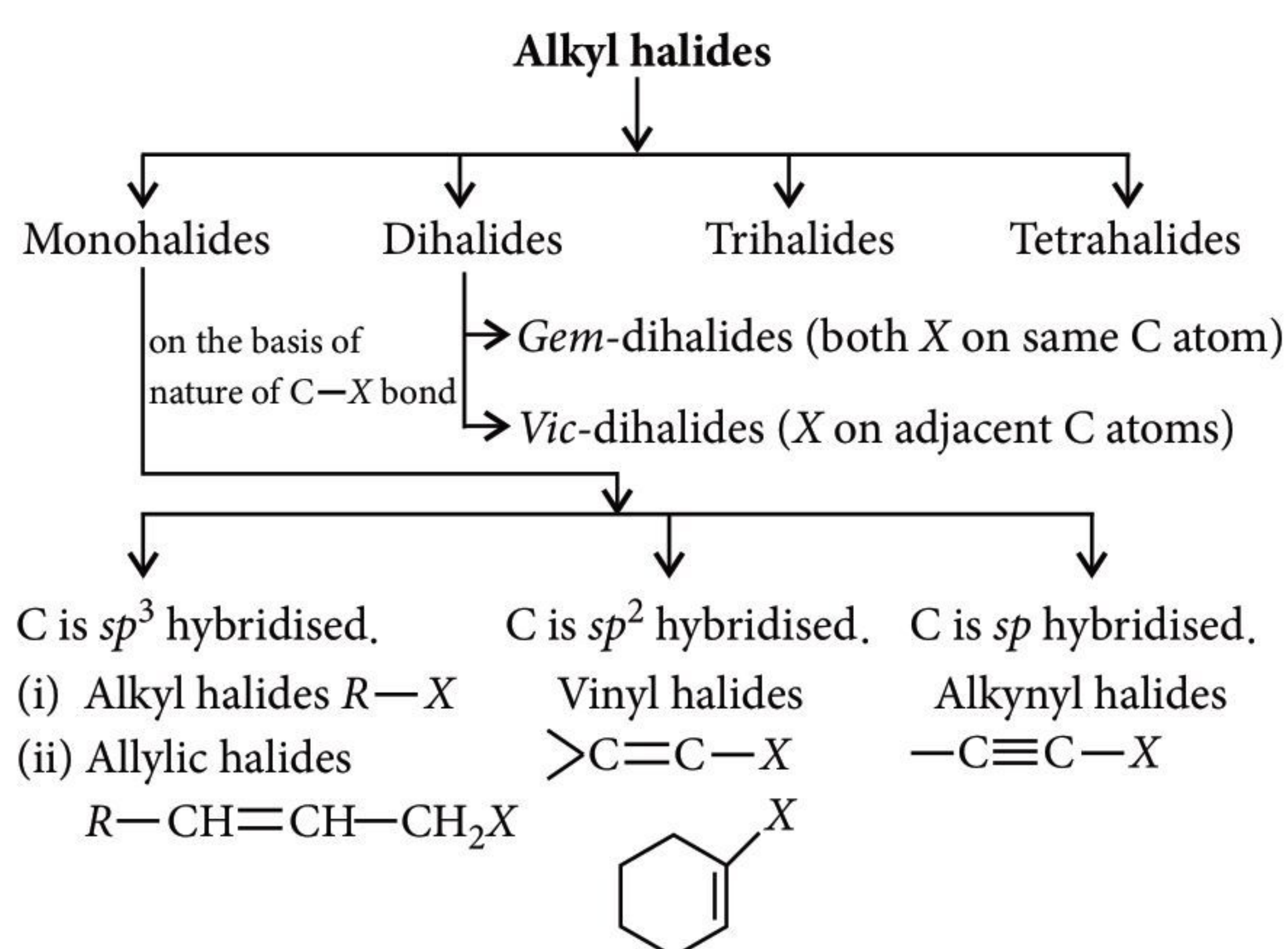
Haloalkanes and Haloarenes | Alcohols, Phenols and Ethers

Haloalkanes and Haloarenes

HALOALKANES

- Compounds obtained from alkanes by the replacement of one or more hydrogens by corresponding number of halogen atoms ($-F$, $-Cl$, $-Br$, $-I$) are termed as *haloalkanes*. e.g., RX .

CLASSIFICATION



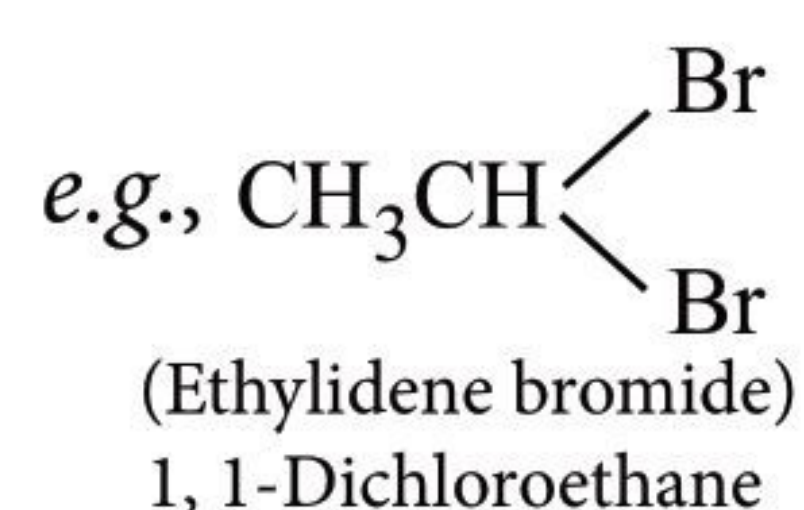
HALOARENES

- When hydrogen atom of the benzene nucleus is substituted by a halogen atom, then haloarenes are formed with general formula C_6H_5X .

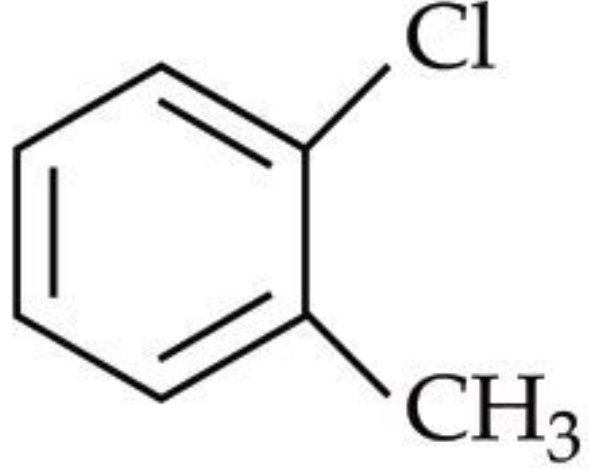
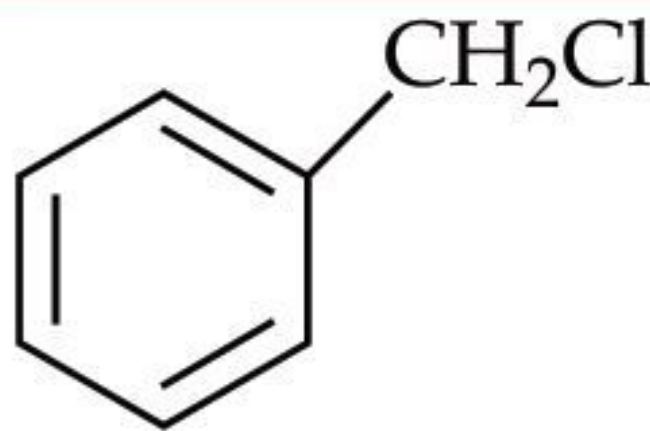
- When hydrogen atom of the side chain attached to benzene is substituted by a halogen atom, then aralkyl halide are formed, e.g., benzyl halide ($C_6H_5CH_2X$).

General Formula and Nomenclature of Alkyl/ Aryl Halides

- Monohalogen derivatives - $C_nH_{2n+1}X$ (alkyl halides)
- Dihalogen derivatives - $C_nH_{2n}X_2$
- Geminal dihalides* are formed when both halogens are on the same C-atom.

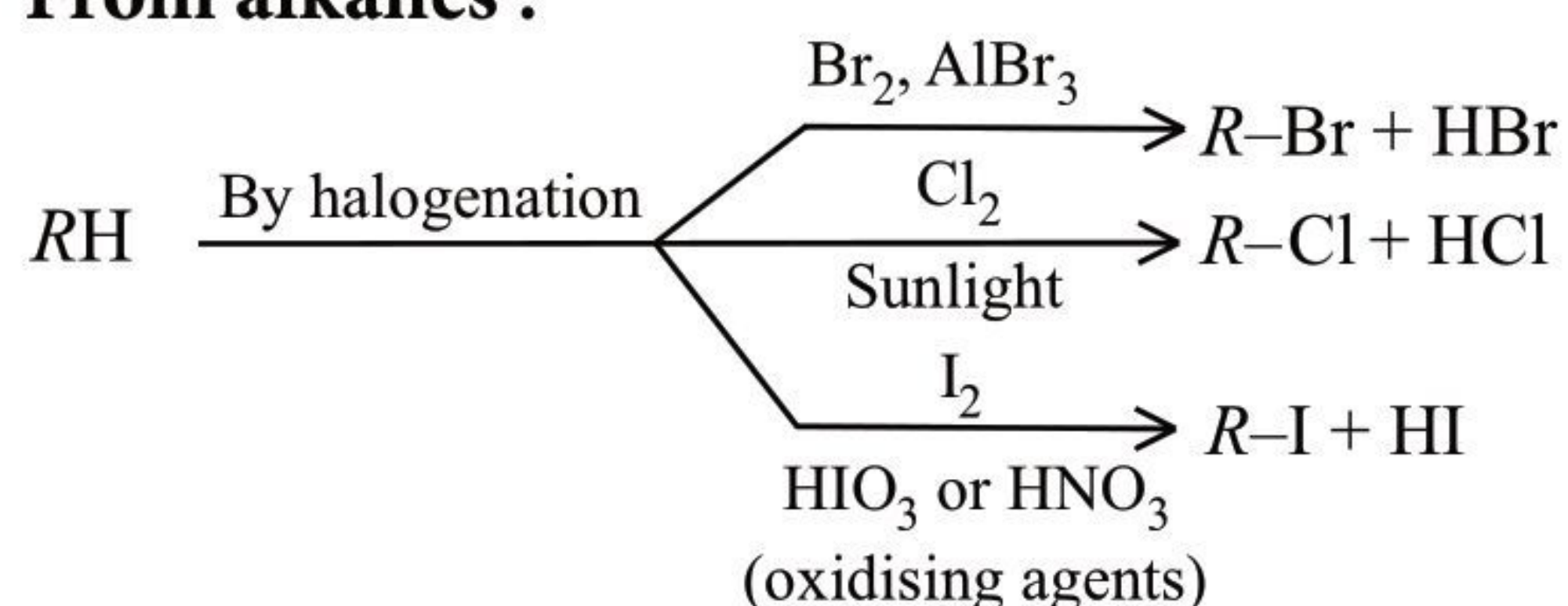


- Vicinal dihalides* are formed when both halogens are attached to adjacent carbon atoms, e.g., ClH_2C-CH_2Cl (ethylene dichloride) 1, 2-Dichloroethane
- Terminal dihalides* are formed when halogens are attached to terminal C-atoms of a compound. e.g., $ClH_2C-CH_2-CH_2-CH_2Cl$ (Tetramethylene dichloride) 1, 4-Dichlorobutane
- General formula of aryl halides is ArX where Ar = aryl group

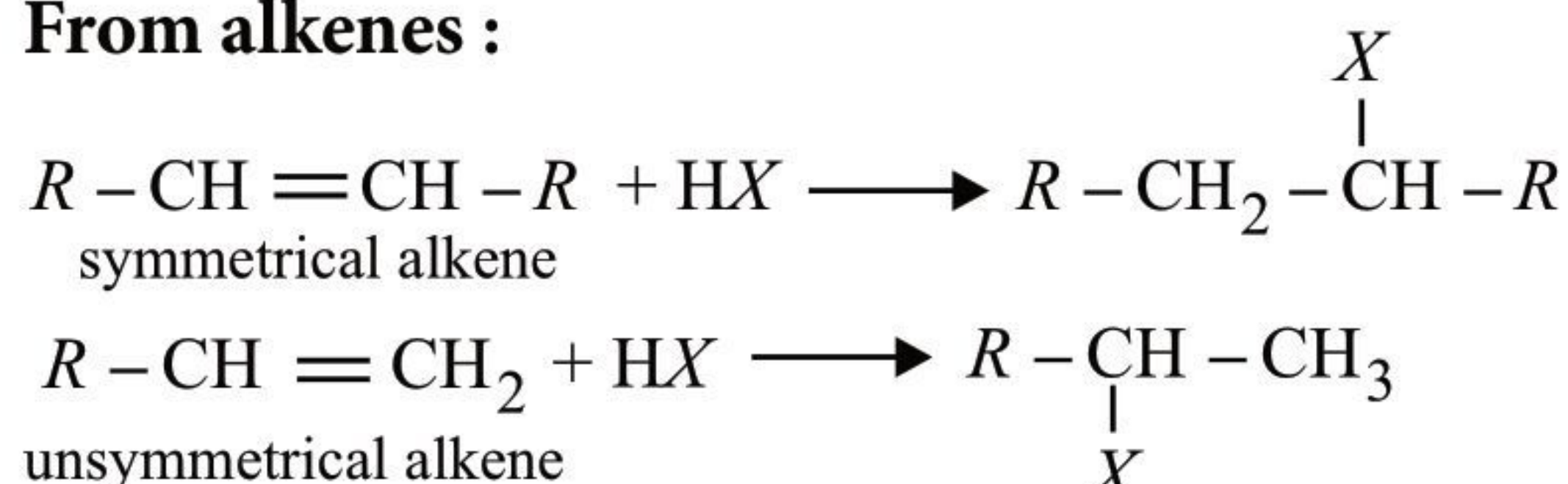
Structure	Common name	IUPAC name
$\text{CH}_3\text{CH}_2\text{CH}(\text{Cl})\text{CH}_3$	<i>sec</i> -Butyl chloride	2-Chlorobutane
$(\text{CH}_3)_3\text{CCH}_2\text{Br}$	<i>neo</i> -Pentyl bromide	1-Bromo-2,2-dimethylpropane
	<i>o</i> -Chlorotoluene	1-Chloro-2-methylbenzene or 2-Chlorotoluene
	Benzyl chloride	Chlorophenylmethane

GENERAL METHODS OF PREPARATION OF ALKYL HALIDES

From alkanes :

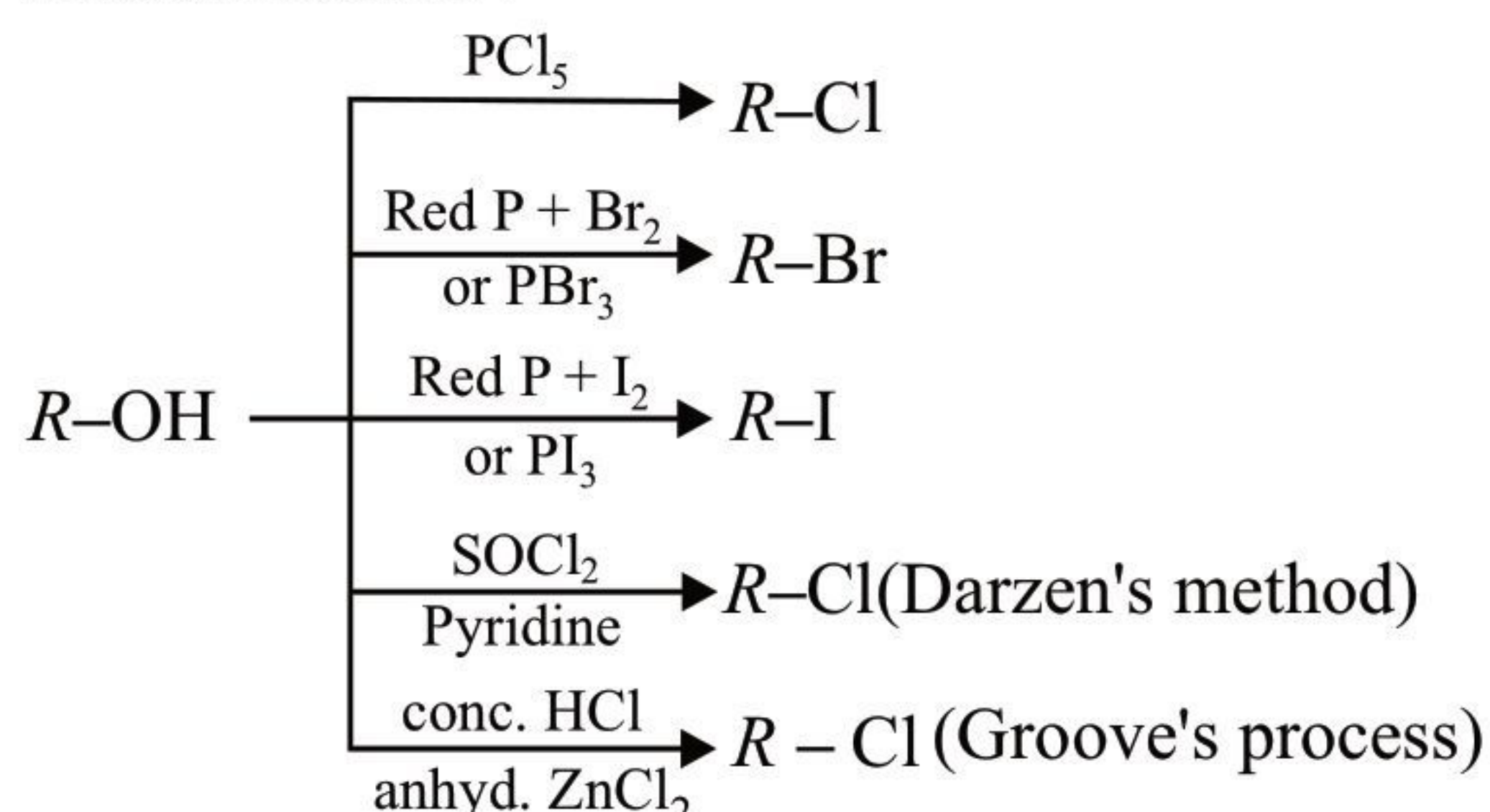


From alkenes :

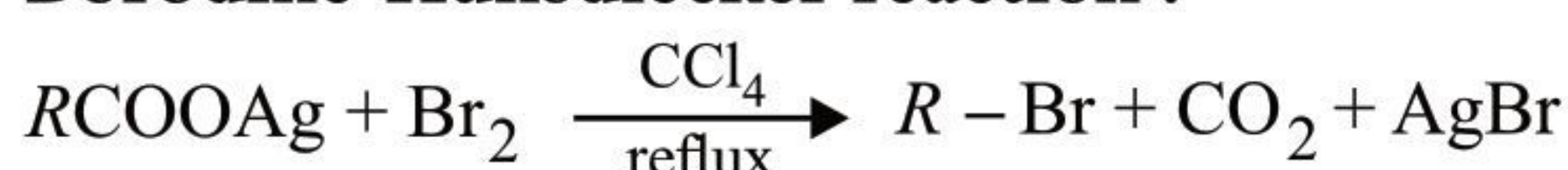


- In the addition of halogen acids to an unsymmetrical alkenes, generally the Markownikoff's rule is followed and the addition occurs through an electrophilic attack. However, in case of reaction with HBr in presence of peroxide, anti-Markownikoff's rule is followed, known as peroxide effect or Kharash effect.
- The order of reactivity of halogen acids with alkenes is $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$.

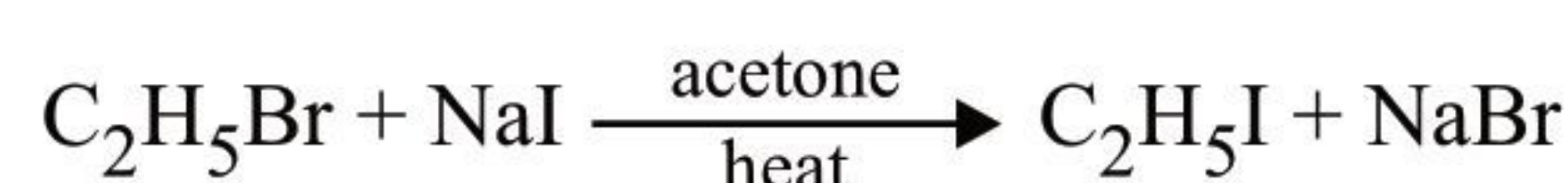
From alcohols :



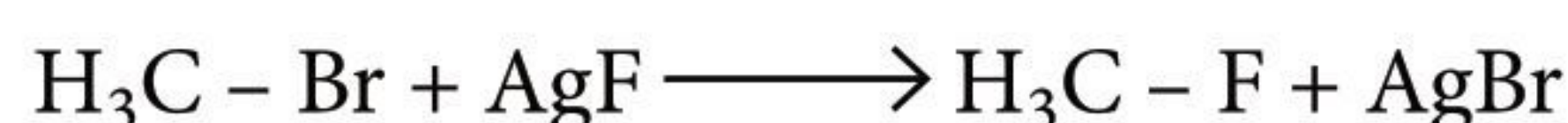
Borodine-Hunsdiecker reaction :



Finkelstein reaction (Halide exchange) :

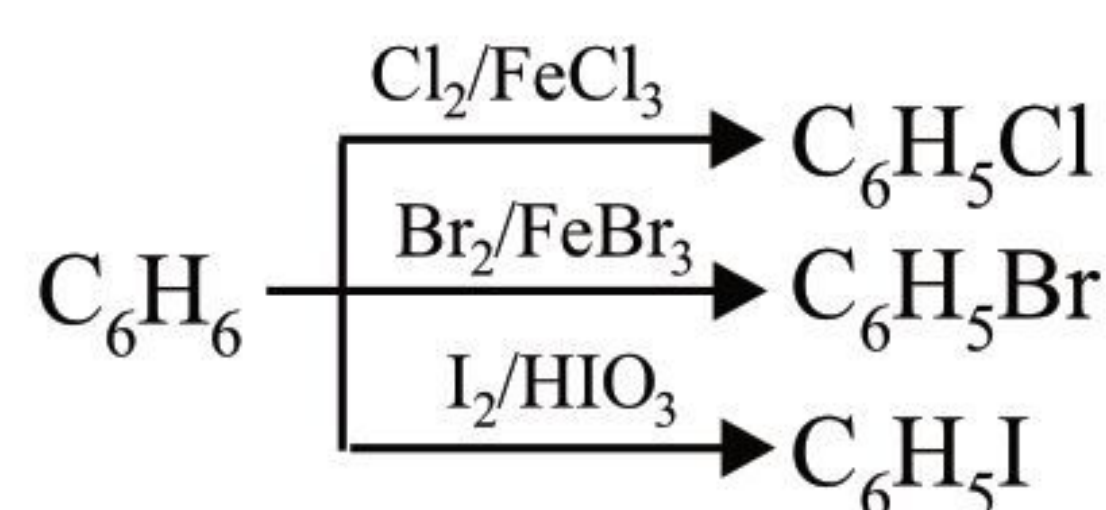


Swart reaction



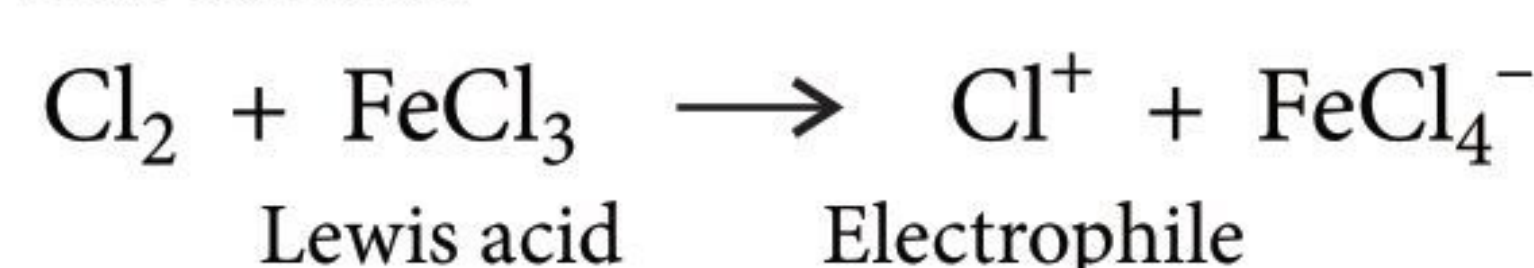
GENERAL METHODS OF PREPARATION OF ARYL HALIDES

By direct halogenation of benzene :

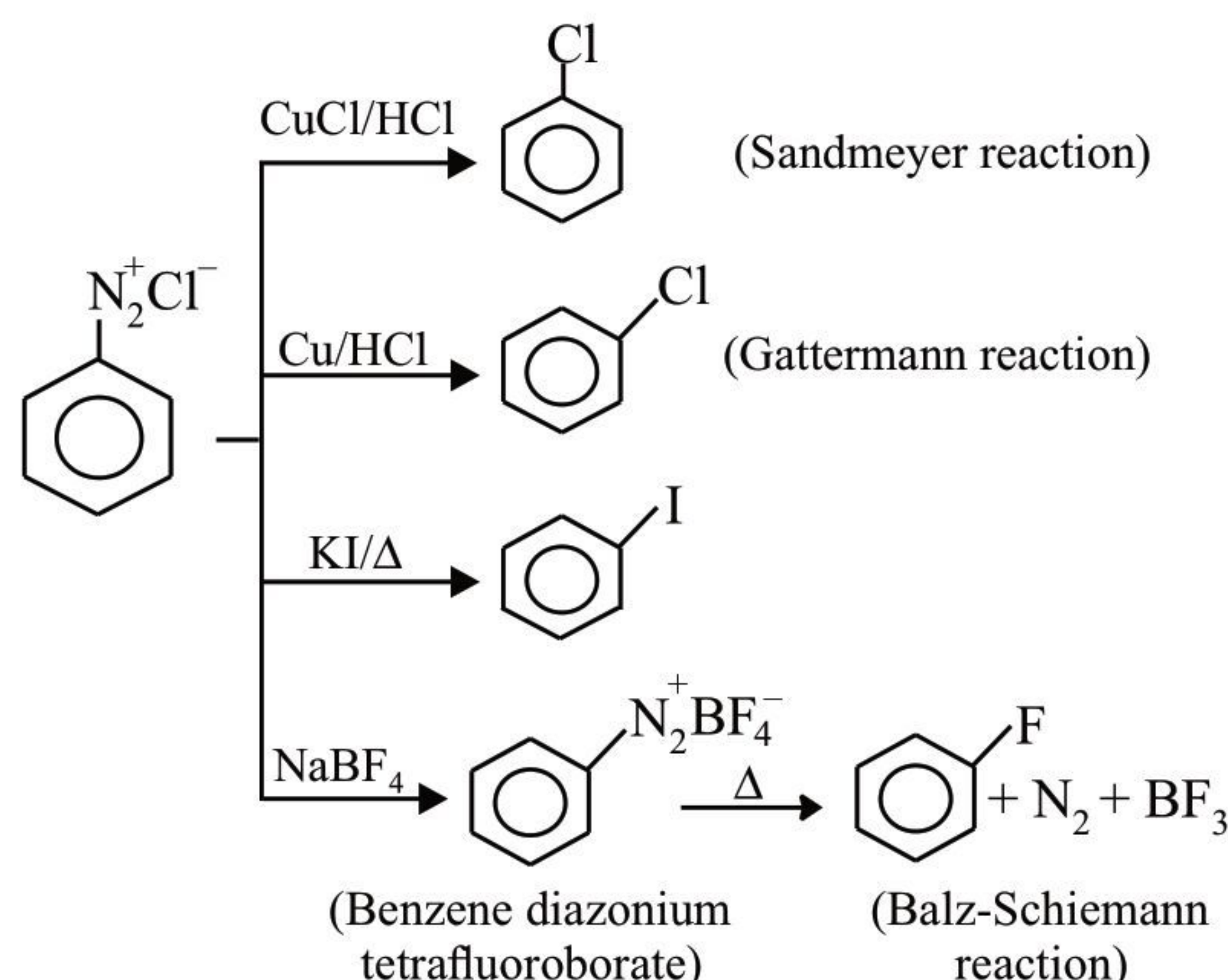


These are electrophilic substitution reactions.

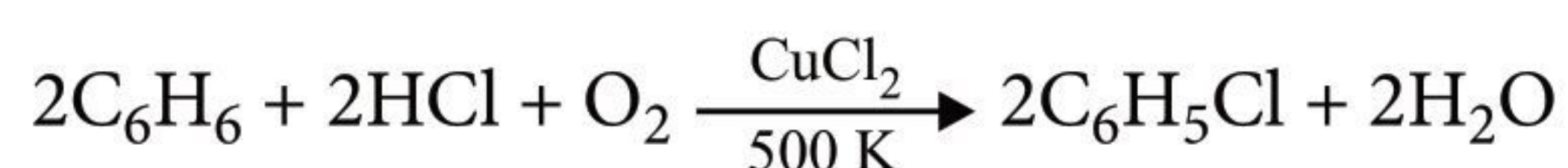
Low temperature and the presence of a halogen carrier favours nuclear substitution. The function of the halogen carrier is to generate the electrophile for the attack.



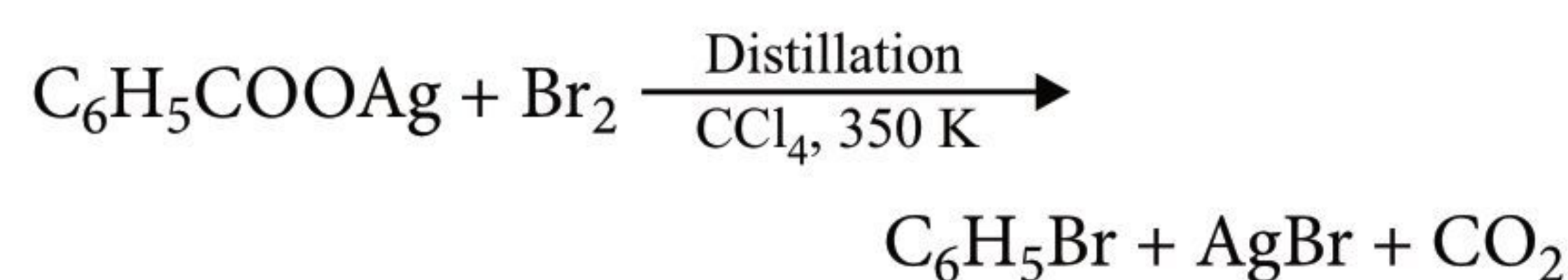
From benzenediazonium salt :



- By Raschig process :



- By Hunsdiecker reaction :



PHYSICAL PROPERTIES OF ALKYL HALIDES

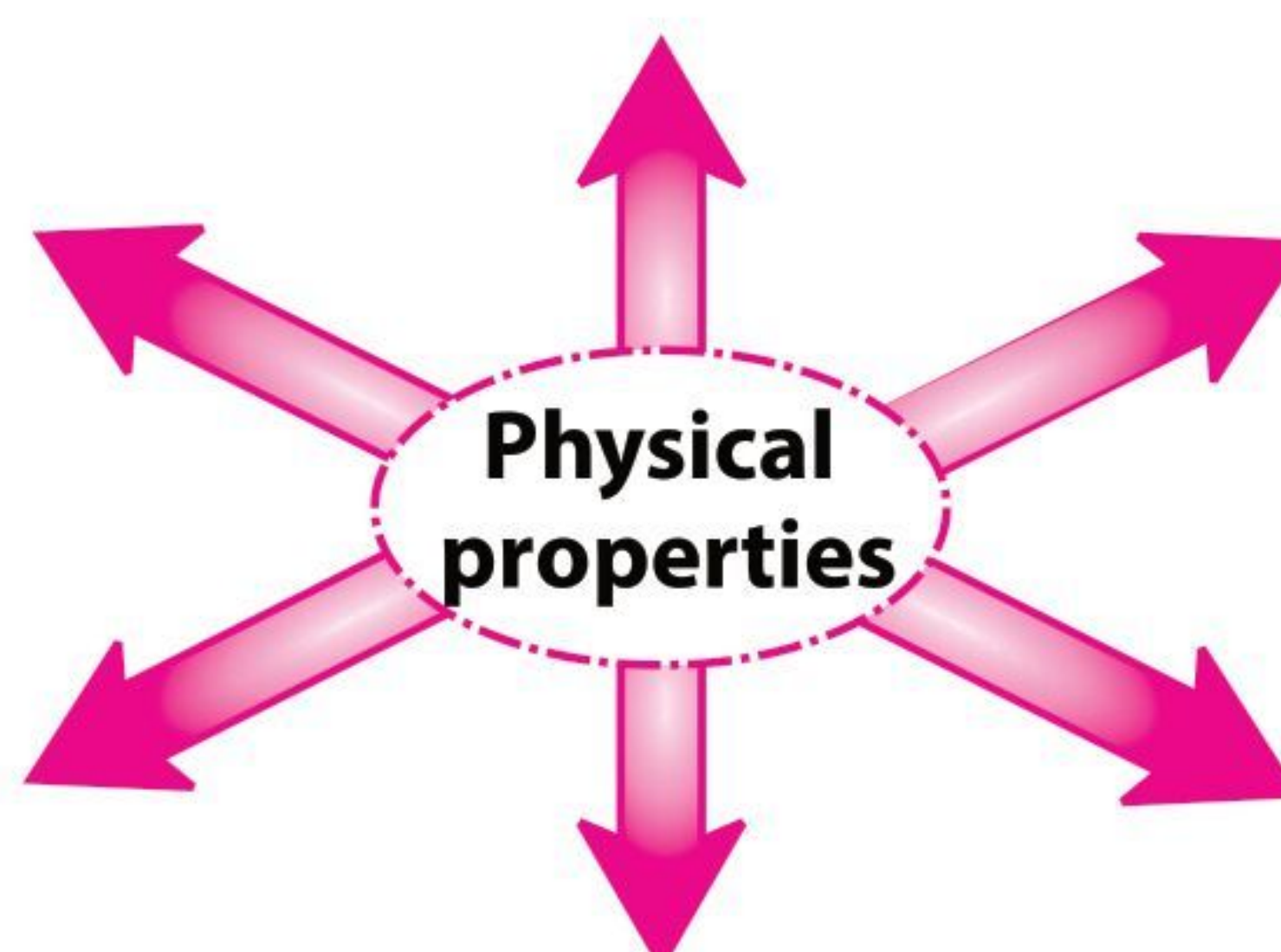
Dipole moment : Haloalkanes are polar compounds and their polarity depends on electronegativity of halogen. Dipole moment of halomethanes are

CH_3Cl	CH_3F	CH_3Br	CH_3I
1.86D	1.84D	1.83D	1.63D

Density : The density increases with atomic mass of halogen and increases with increase in size of alkyl group.

- For same alkyl group, density follows the order
 $\text{R—I} > \text{R—Br} > \text{R—Cl} > \text{R—F}$
- For same halogen atom, density follows the order
 $\text{CH}_3\text{X} < \text{C}_2\text{H}_5\text{X} < \text{C}_3\text{H}_7\text{X}$

Physical state and smell : Lower members are colourless gases at room temperature, alkyl halides up to C_{18} are colourless sweet smelling liquids while higher members are colourless solids.



Boiling point : The boiling point increases from R—F to R—I



- Boiling point increases with increase in size of alkyl group *i.e.*, $\text{CH}_3\text{X} < \text{C}_2\text{H}_5\text{X} < \text{C}_3\text{H}_7\text{X}$, etc.
- For isomeric alkyl halides, boiling point decreases with branching.

Solubility : Haloalkanes are insoluble in water but soluble in organic solvents.

Bond strength : Bond strength of carbon-halogen bond decreases with increase in the bond length as we move from fluorine to iodine.
 $\text{C—F} > \text{C—Cl} > \text{C—Br} > \text{C—I}$

PHYSICAL PROPERTIES OF ARYL HALIDES

Physical state and smell : Haloarenes are generally colourless liquids with pleasant odour or are crystalline solids with characteristic smell.

Physical properties

Boiling point : boiling points of monohalogen derivatives of benzene are in order



Boiling and melting points increase as the size of the aryl group increases.

Solubility : Aryl halides are insoluble in water but readily miscible with organic solvents.

Density : Aryl halides are heavier than water. density follows the order
 $\text{Aryl iodide} > \text{aryl bromide} > \text{aryl chloride}$

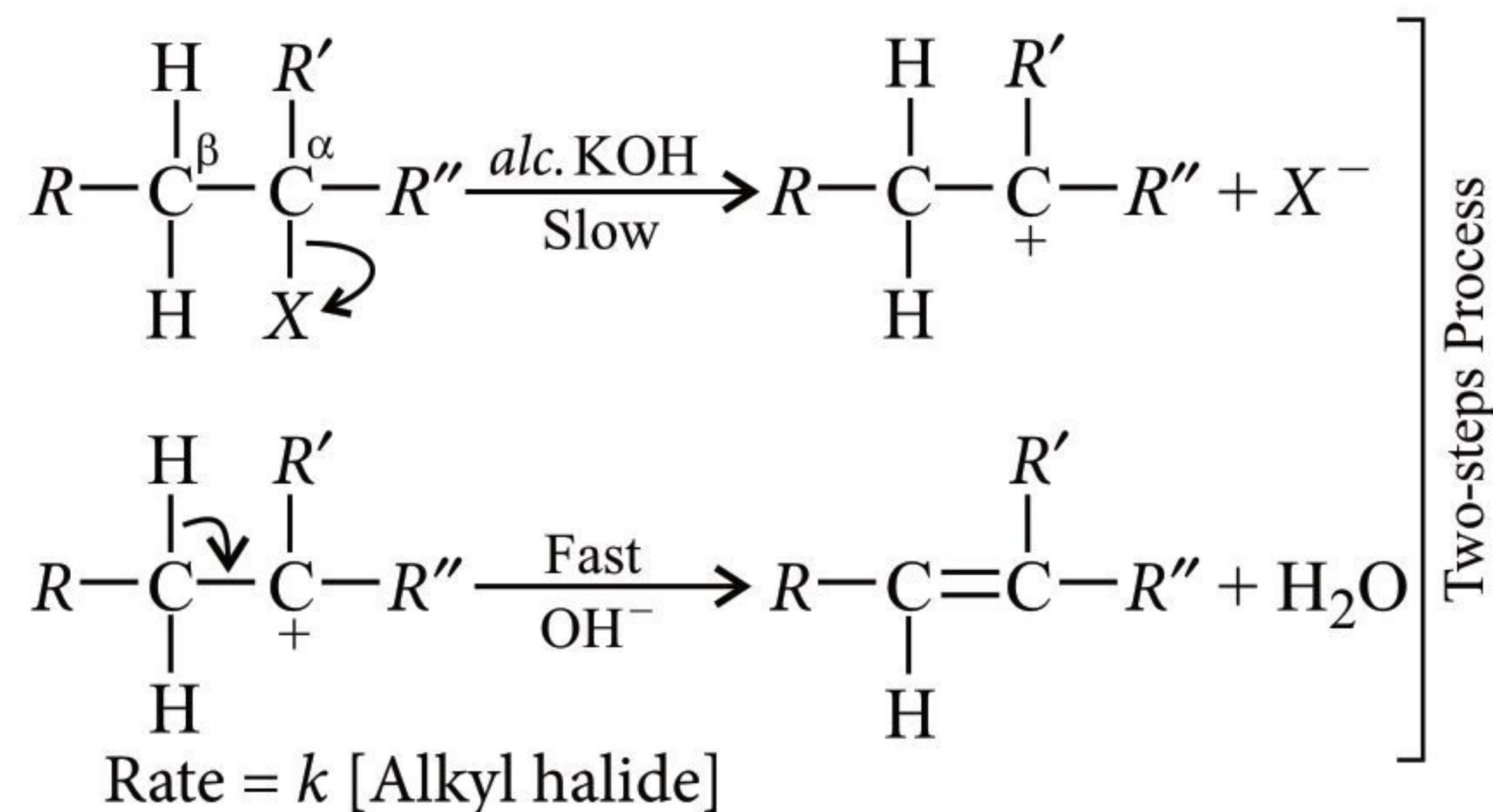
Dipole moment : Aryl halides are less polar than alkyl halides due to resonance.

CHEMICAL PROPERTIES OF ALKYL HALIDES

Elimination reactions

- Alkyl halides undergo β -elimination reaction in the presence of potassium hydroxide in ethanol (high temperature) to yield alkene by E1 or E2 mechanism according to the structure of alkyl halides.

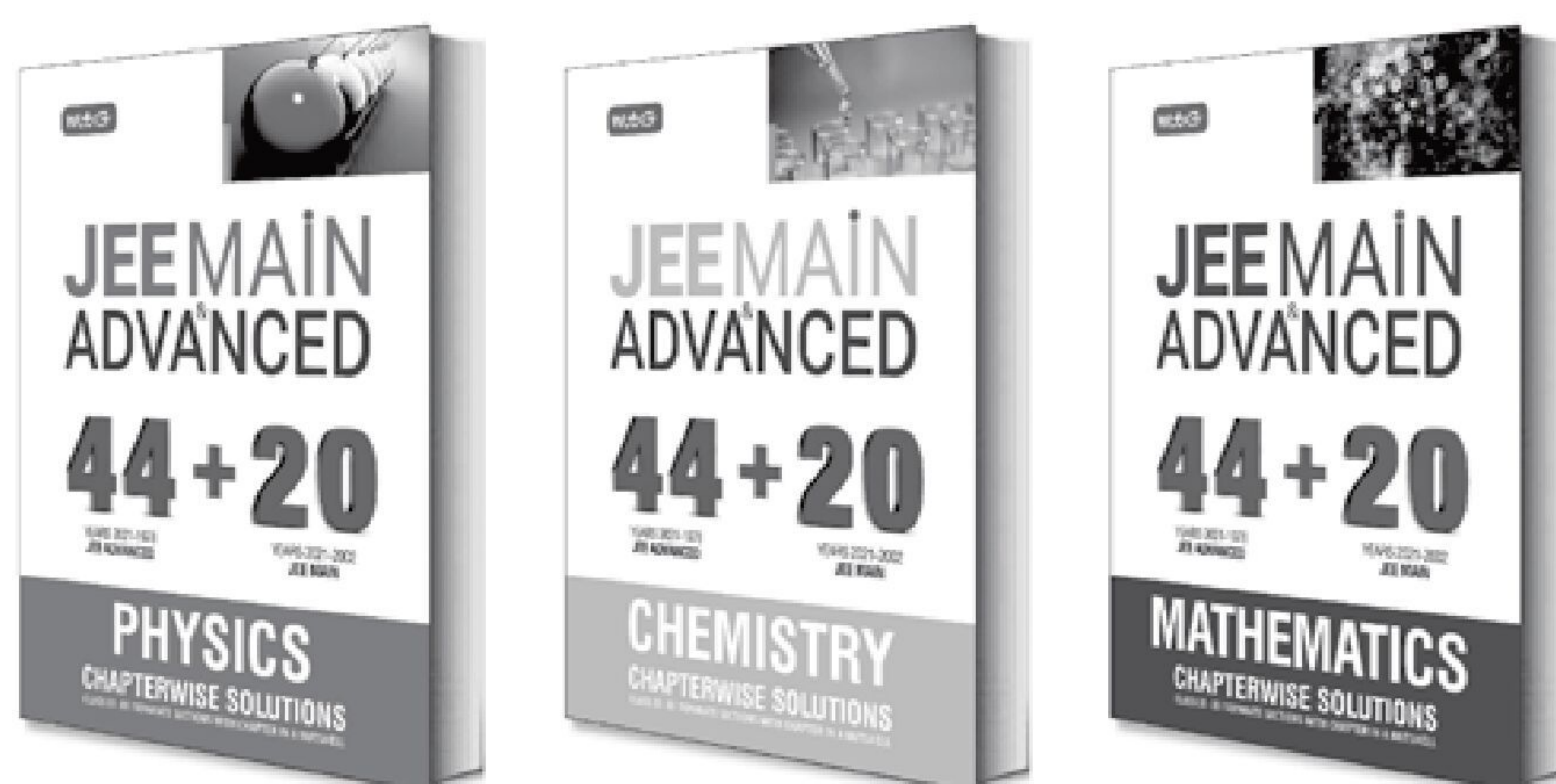
- E1 mechanism :





Some of the best lessons are learnt from history!

Introducing Chapterwise Solutions to JEE.
Crack the past to see if you will last.



Tune. Fine tune. Reach the peak of your readiness for JEE with MTG's 44+20 Years Chapterwise Solutions. It is undoubtedly the most comprehensive 'real' question bank, complete with detailed solutions by experts.

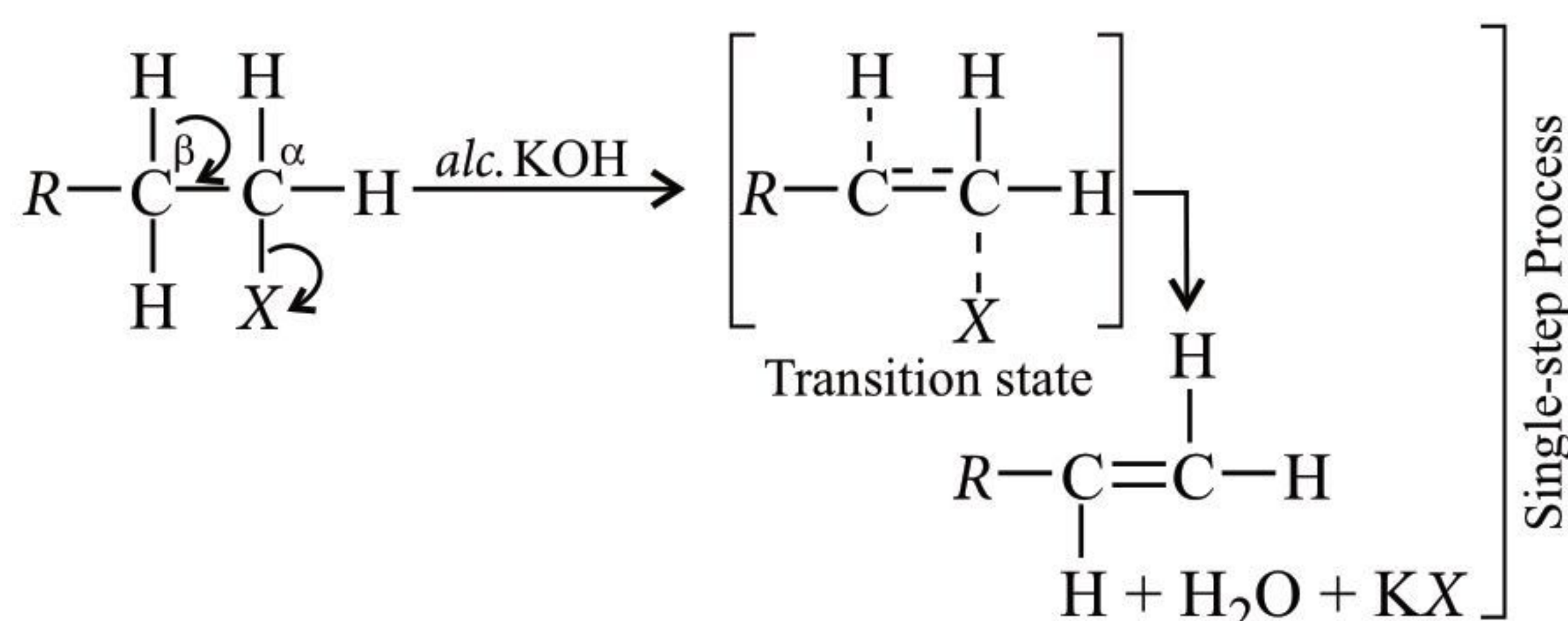
Studies have shown that successful JEE aspirants begin by familiarising themselves with the problems that have appeared in past JEEs as early as 2 years in advance.

Making it one of the key ingredients for their success. How about you then?
Get 44+20 Years Chapterwise Solutions to start your rehearsals early.



Available at all leading book shops throughout the country.
For more information or for help in placing your order:
Visit www.mtg.in to buy online!
Call 0124-6601200 or e-mail: info@mtg.in

• **E2 mechanism :**

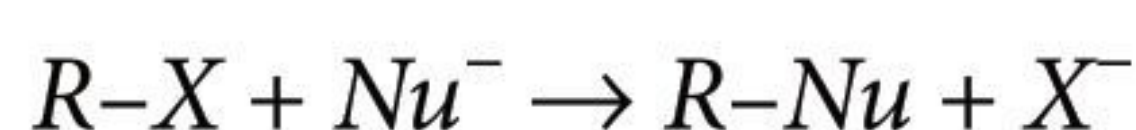


$$\text{Rate} = k [\text{Alkyl halide}] [\text{base}]$$

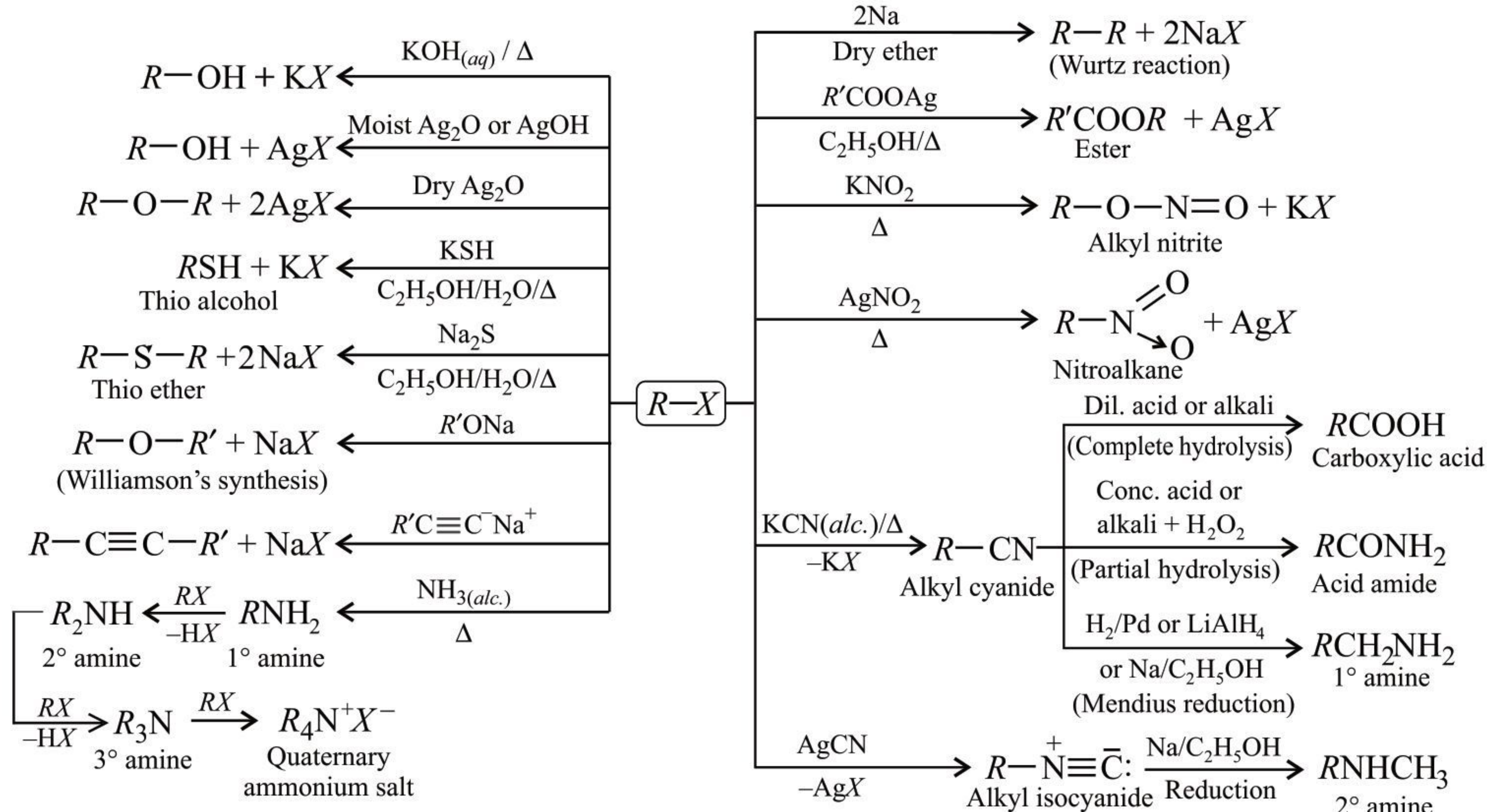
In E2, both departing groups H and X must be situated at anti position on adjacent carbon atoms.

Nucleophilic Substitution Reaction

- Alkyl halides undergo nucleophilic substitution reaction in which an incoming nucleophile substitutes the halogen.
- Consider a general reaction :



Some Important Nucleophilic Substitution Reactions



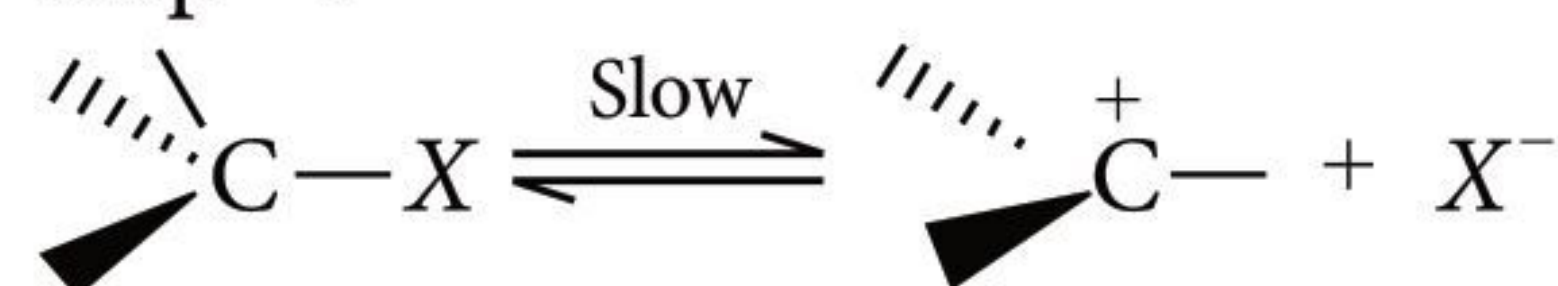
CHEMICAL PROPERTIES OF ARYL HALIDES

- Nucleophilic substitution reactions :** Due to resonance effect, haloarenes acquire some double bond character between C—X bond, making them inert towards nucleophile but Cl-atom of chlorobenzene can be replaced by a nucleophile either

• **S_N1 Reaction (Substitution nucleophilic unimolecular)**

- The S_N1 mechanism is a two step process, first one being the slow and the rate determining step.

Step - 1



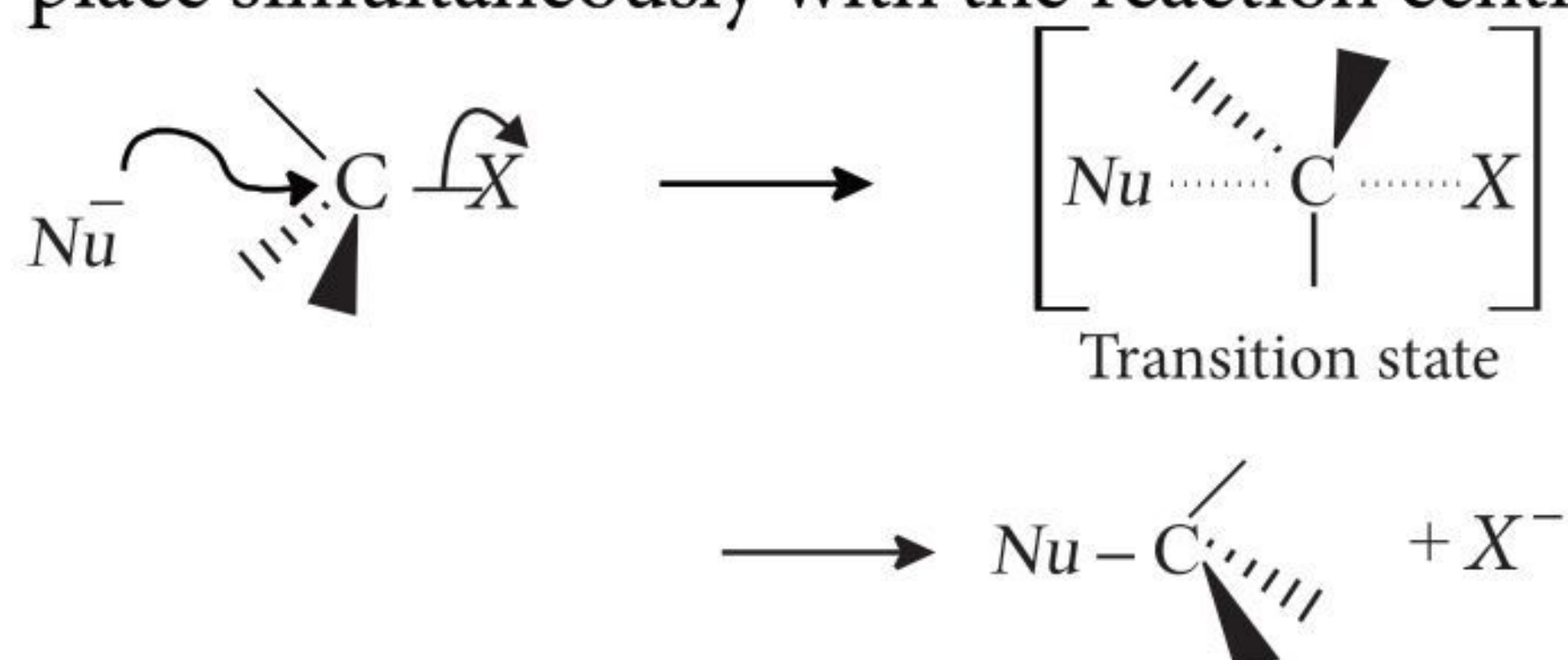
Step - 2



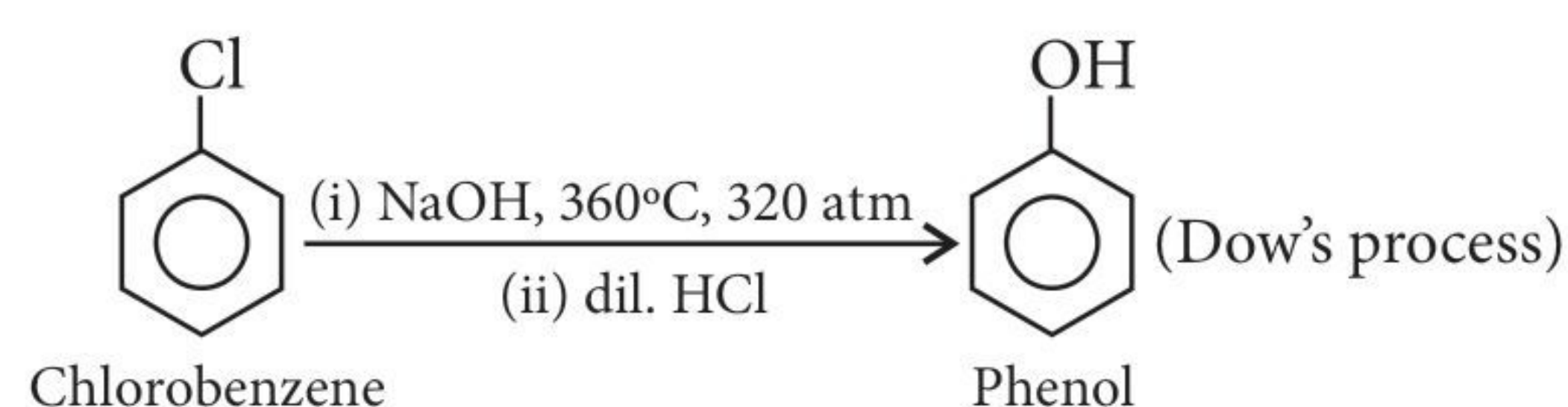
- The reaction follows first order kinetics. The rate of reaction is independent of the concentration of nucleophile.

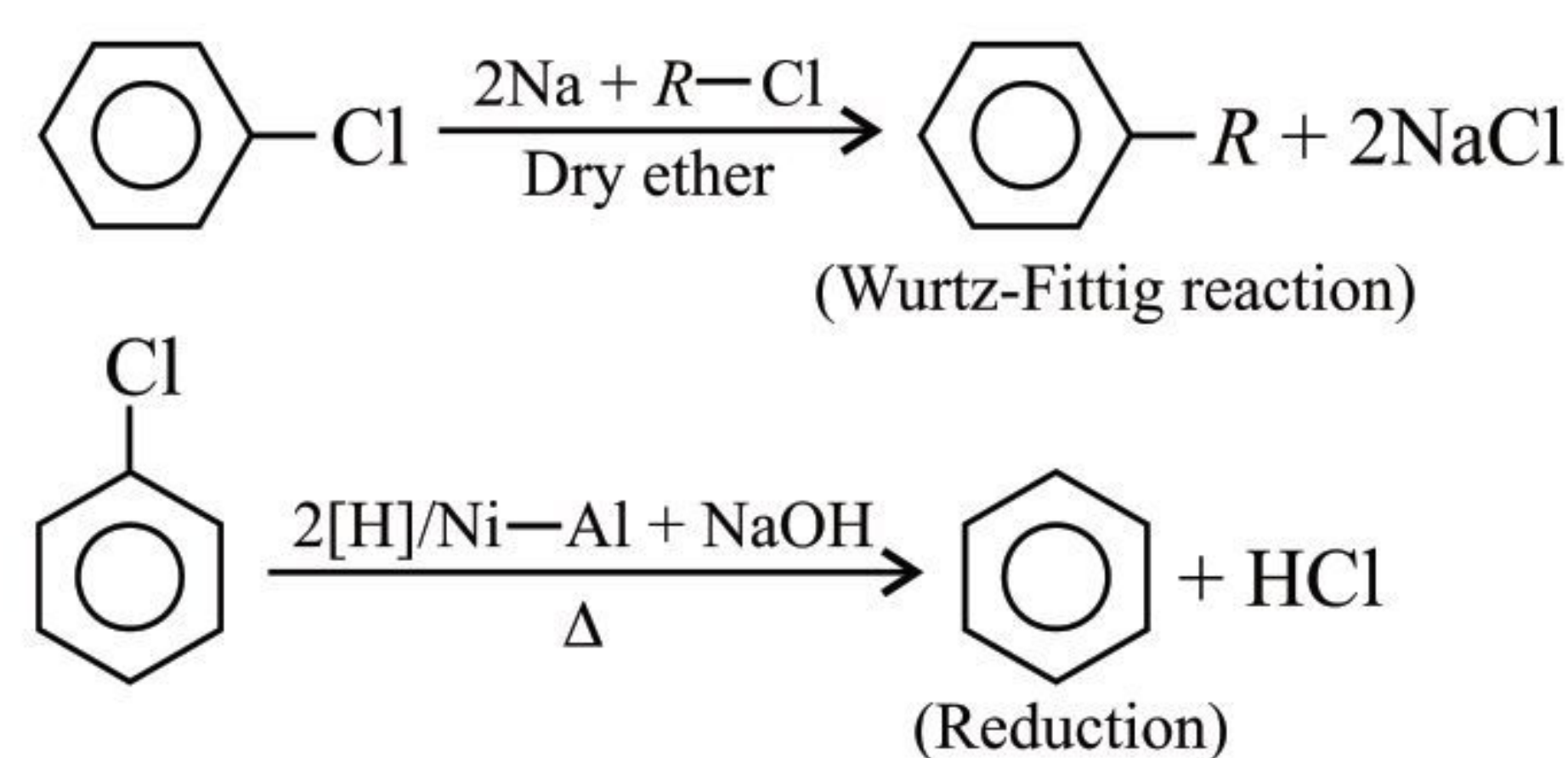
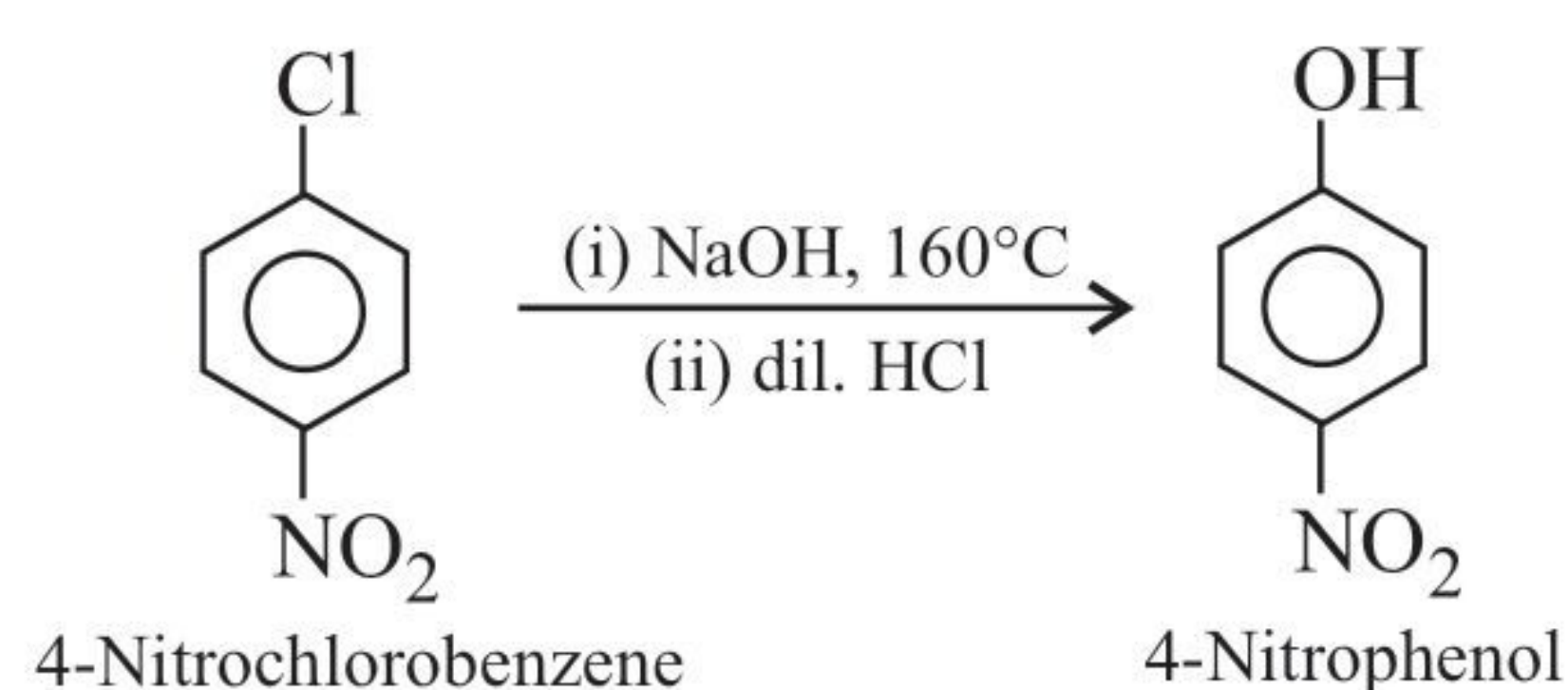
• **S_N2 Reaction (Substitution nucleophilic bimolecular)**

- The S_N2 mechanism is a single step process with no intermediate. Bond making and breaking take place simultaneously with the reaction centre.

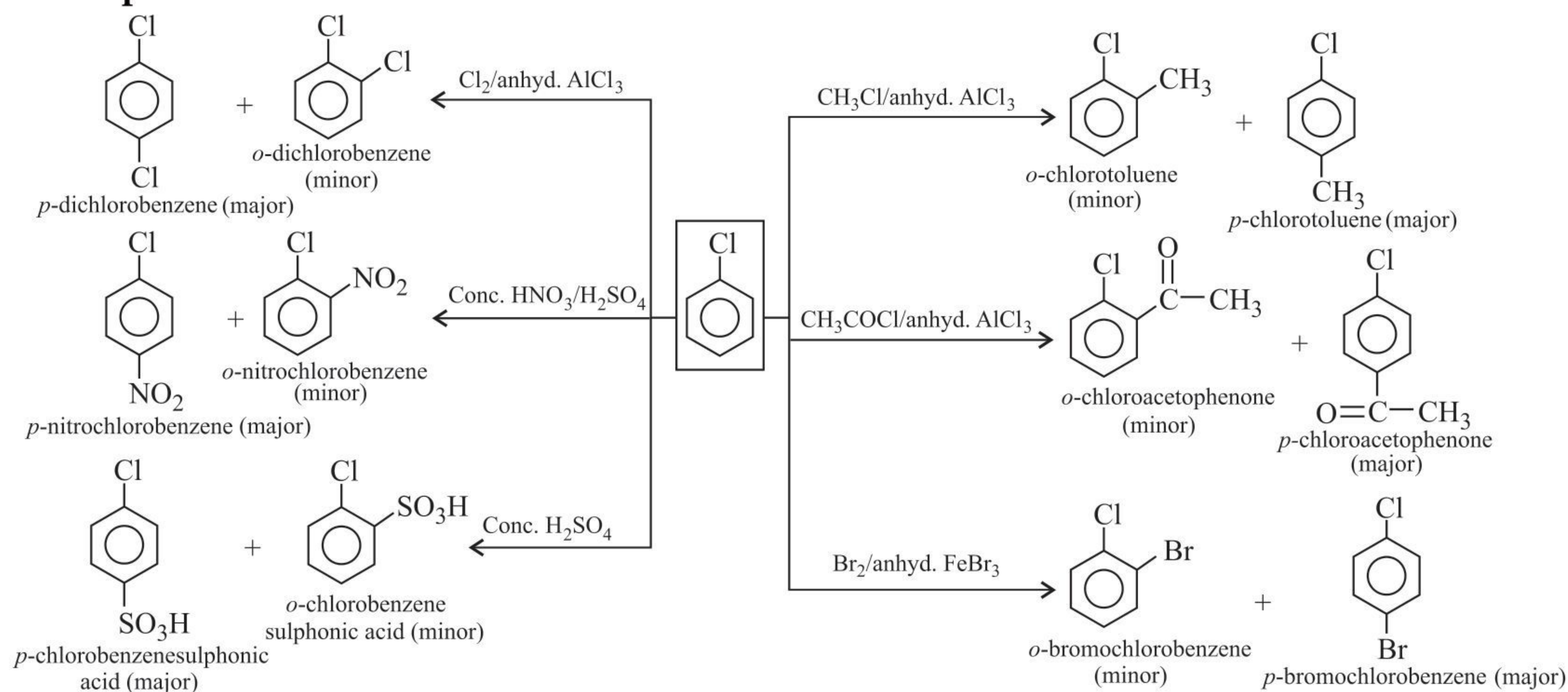


- (i) by placing electron withdrawing group at *ortho* and *para* positions or (ii) by using drastic conditions i.e., by applying high temperature and pressure.





● **Electrophilic substitution reactions :**



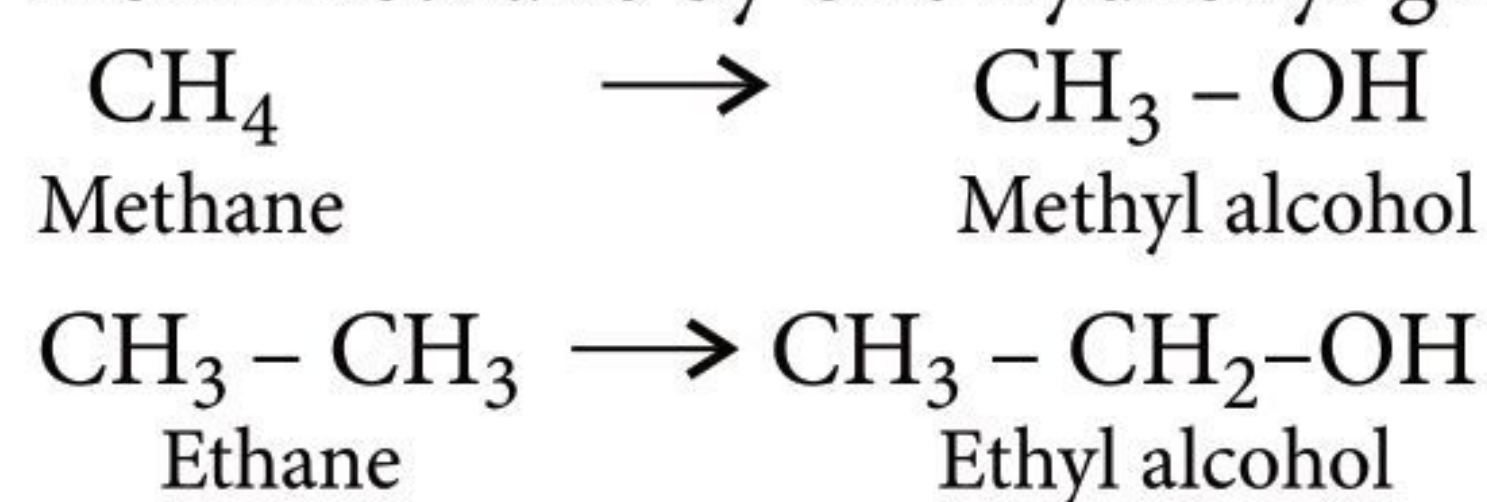
BASIS CONCEPTS ABOUT OPTICAL ISOMERISM

- Optical isomer is known as *dextrorotatory isomer* (latin: *dexter* means right) (*d*-form or +ve) if optically active substance rotates the plane polarised light to the right (clockwise) and *laevorotatory isomer* (latin: *laevo* means left) (*l*-form or -ve) if it rotates the plane polarised light to the left (anticlockwise).
- Chirality** : The compound is said to have chirality if the central carbon atom is attached to four different groups and this centre is called *chiral (asymmetric) centre* or *stereogenic centre* or *stereocentre*.
- Achirality** : The compound is said to have achirality if the central carbon atom have atleast two identical groups and this centre is called *achiral (symmetric)*.
- If molecule has a plane of symmetry or centre of symmetry it is *achiral (not chiral)* and if molecule has no plane of symmetry or centre of symmetry it is *chiral*.
- Enantiomers/*d*- and *l*-isomers** : They are the optical isomers which are non-superimposable mirror images (or dissymmetric).
- An equimolar mixture of the *d*-form and *l*-form will be optically inactive and is called *racemic mixture* (or *dl*-form or (\pm) -mixture).
- The process of conversion of an enantiomer into racemic mixture is known as *racemisation*.
- Diastereomers** : They are the optical isomers which are not mirror images of each other. They have different physical properties and magnitude of specific rotation.
- Meso compounds** : These compounds which have even number of chiral carbon atoms and have an internal plane of symmetry. They are optically inactive due to internal compensation.

Alcohols, Phenols and Ethers

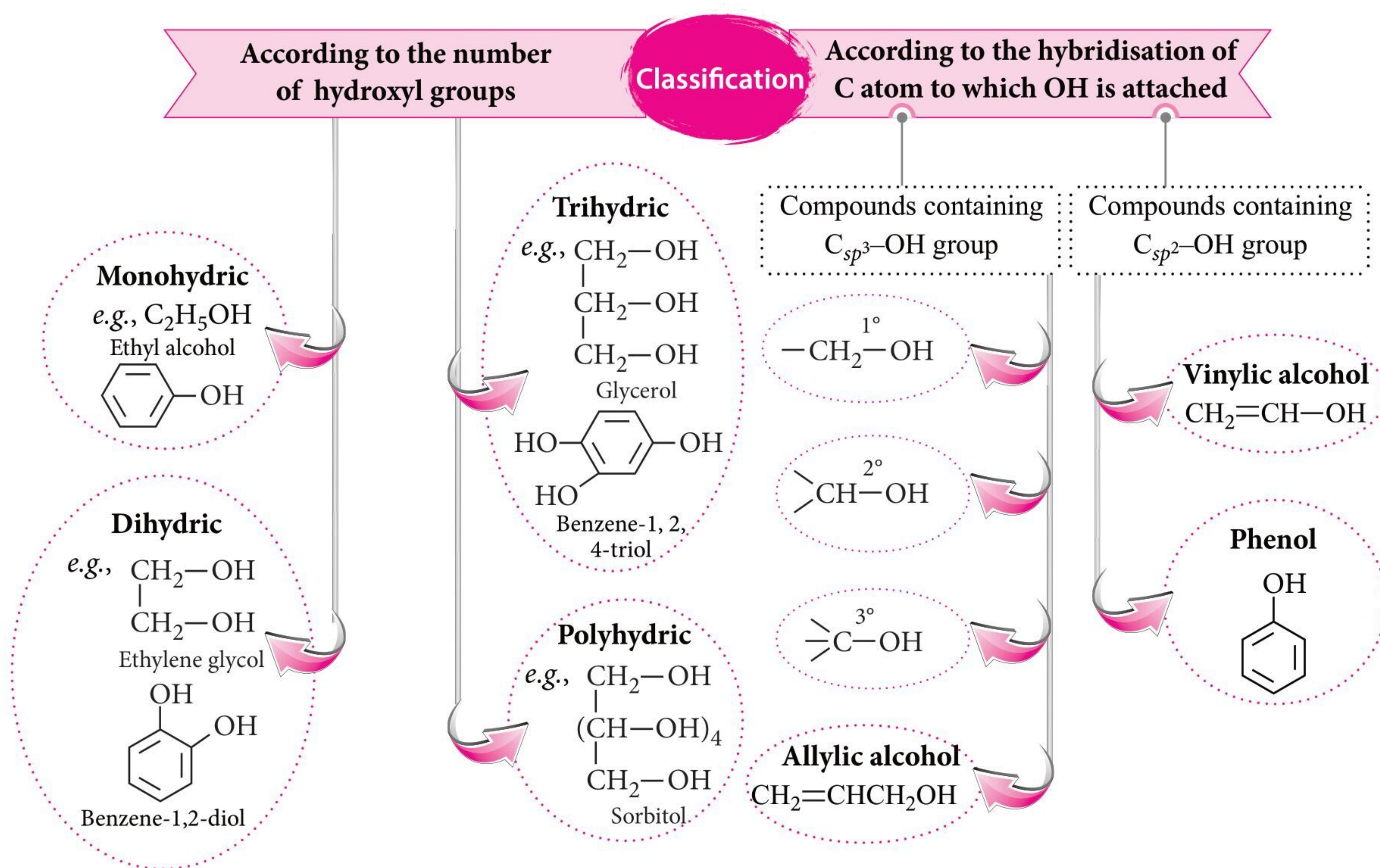
- Alcohols are the hydroxy derivatives of alkanes having general formula $\text{C}_n\text{H}_{2n+1}\text{OH}$.
- Alcohols are the hydroxyl derivatives of hydrocarbons in which one or more hydrogen atoms are replaced by $-\text{OH}$ group *e.g.*, methyl

alcohol is derived by replacing a hydrogen atom from methane by one hydroxyl group.

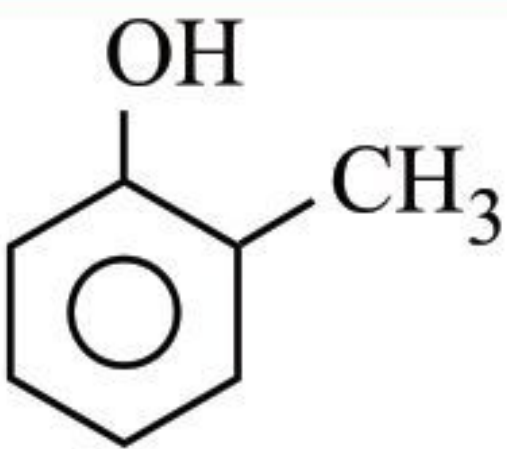
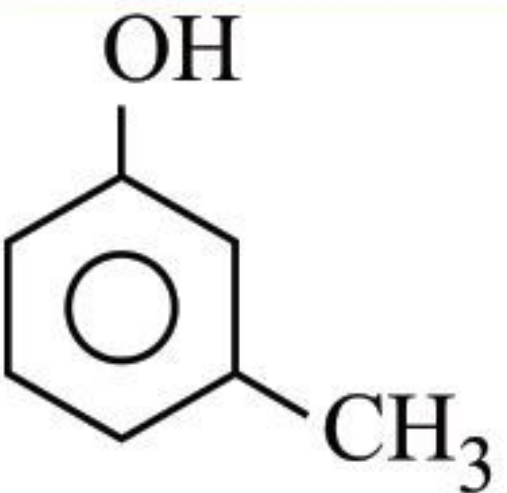


- Phenols are the compounds in which hydroxy ($-\text{OH}$) group is directly linked to aromatic ring having formula $\text{C}_6\text{H}_5\text{OH}$.

CLASSIFICATION OF ALCOHOLS AND PHENOLS



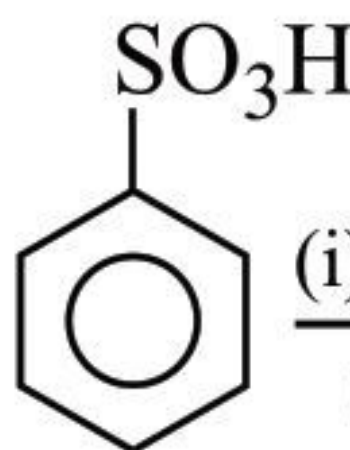

NOMENCLATURE

Class of compounds	Formula	General Name	IUPAC Name
Alcohols	$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$	<i>n</i> -Propyl alcohol	Propan-1-ol
	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$	<i>iso</i> -Propyl alcohol	Propan-2-ol
Phenols		<i>o</i> -Cresol	2-Methylphenol
		<i>m</i> -Cresol	3-Methylphenol
Ethers	$\text{CH}_3\text{OC}_2\text{H}_5$	Ethylmethyl ether	Methoxyethane
	$\text{C}_6\text{H}_5\text{OCH}_3$	Anisole	Methoxybenzene

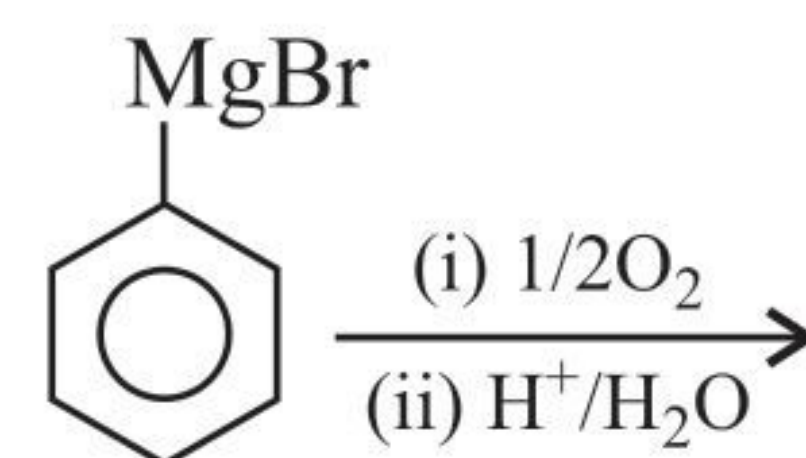
METHODS OF PREPARATION OF ALCOHOLS

Hydration of alkenes	$RCH=CH_2 \xrightarrow[\text{(Hydration)}]{H_2O/H^+}$	A
Hydroboration oxidation	$RCH=CH_2 \xrightarrow{B_2H_6/H_2O_2, OH^-}$	L
Oxymercuration reduction	$RCH=CH_2 \xrightarrow[(ii) NaBH_4]{(i) Hg(OAc)_2; H_2O}$	C
From Grignard reagent	$>C=O \xrightarrow[(ii) H^+/H_2O]{(i) RMgX}$	O
From aliphatic primary amines	$RNH_2 + HONO \longrightarrow$	H
From haloalkanes	$R-X + KOH_{(aq)} \longrightarrow$	O
From carbonyl compounds	$RCHO \xrightarrow[\text{or } LiAlH_4]{H_2/Ni}$ $R_2C=O \xrightarrow{H_2/Ni}$ $RCOOH \xrightarrow{LiAlH_4}$ $RCOOR' \xrightarrow{LiAlH_4}$ $RCOOR' \xrightarrow{Na/C_2H_5OH}$	L S

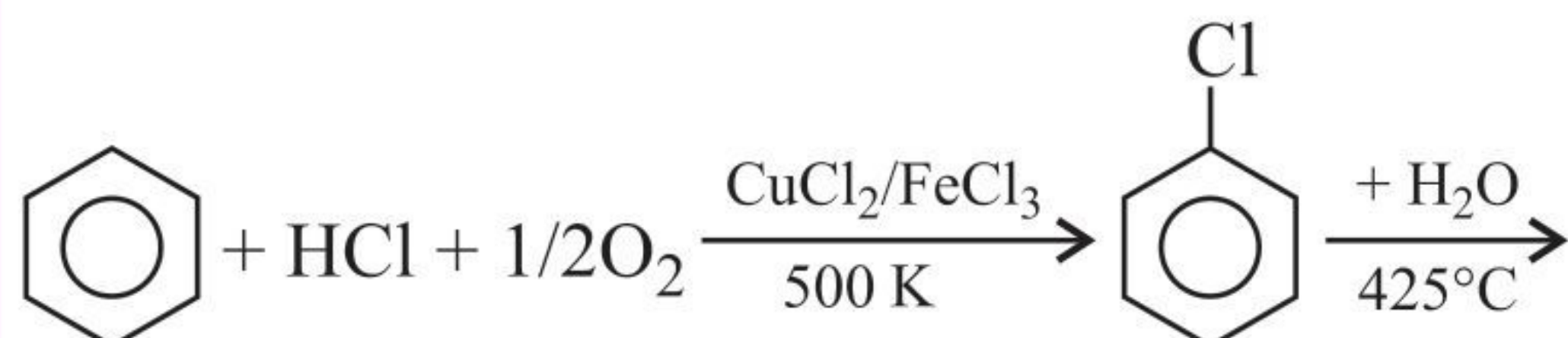
METHODS OF PREPARATION OF PHENOLS

From benzene sulphonic acid	 $\xrightarrow[(ii) H_2O/H^+]{(i) NaOH \text{ (fusion)}}$	P
From diazonium salts	 $\xrightarrow[\text{dil. } H_2SO_4]{H_2O/\Delta}$	H

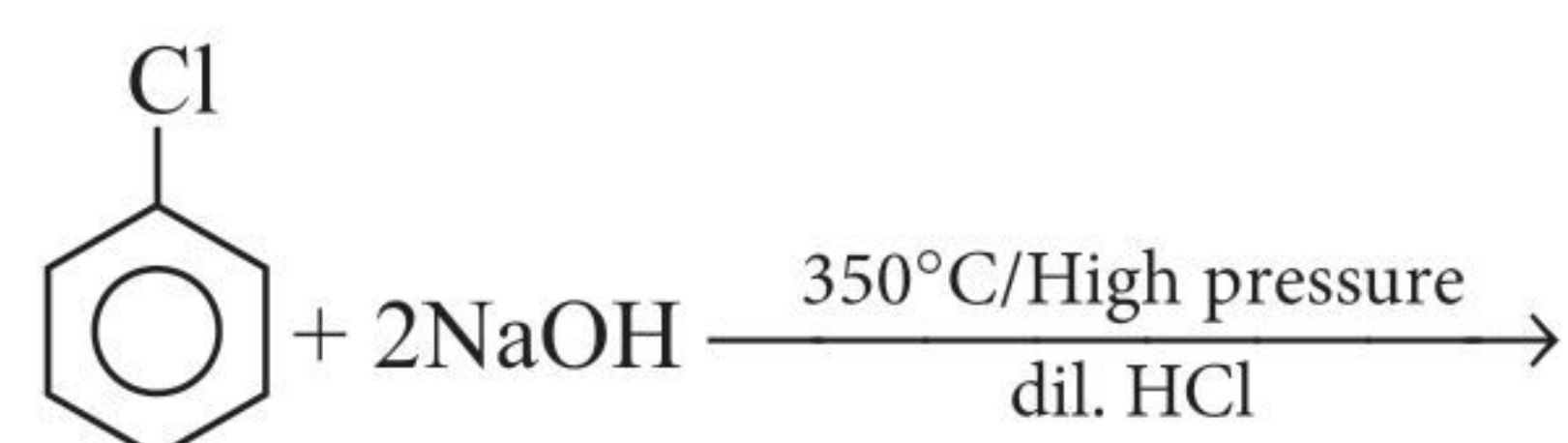
From Grignard reagent



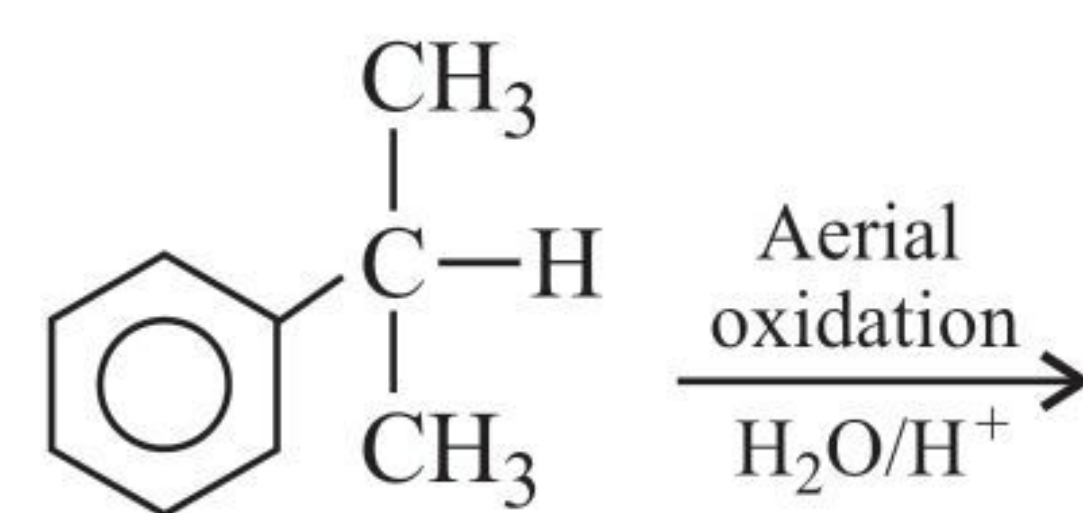
Raschig's process




Dow's process



From cumene






ONLINE TEST SERIES

Practice Part Syllabus/ Full Syllabus
24 Mock Tests for

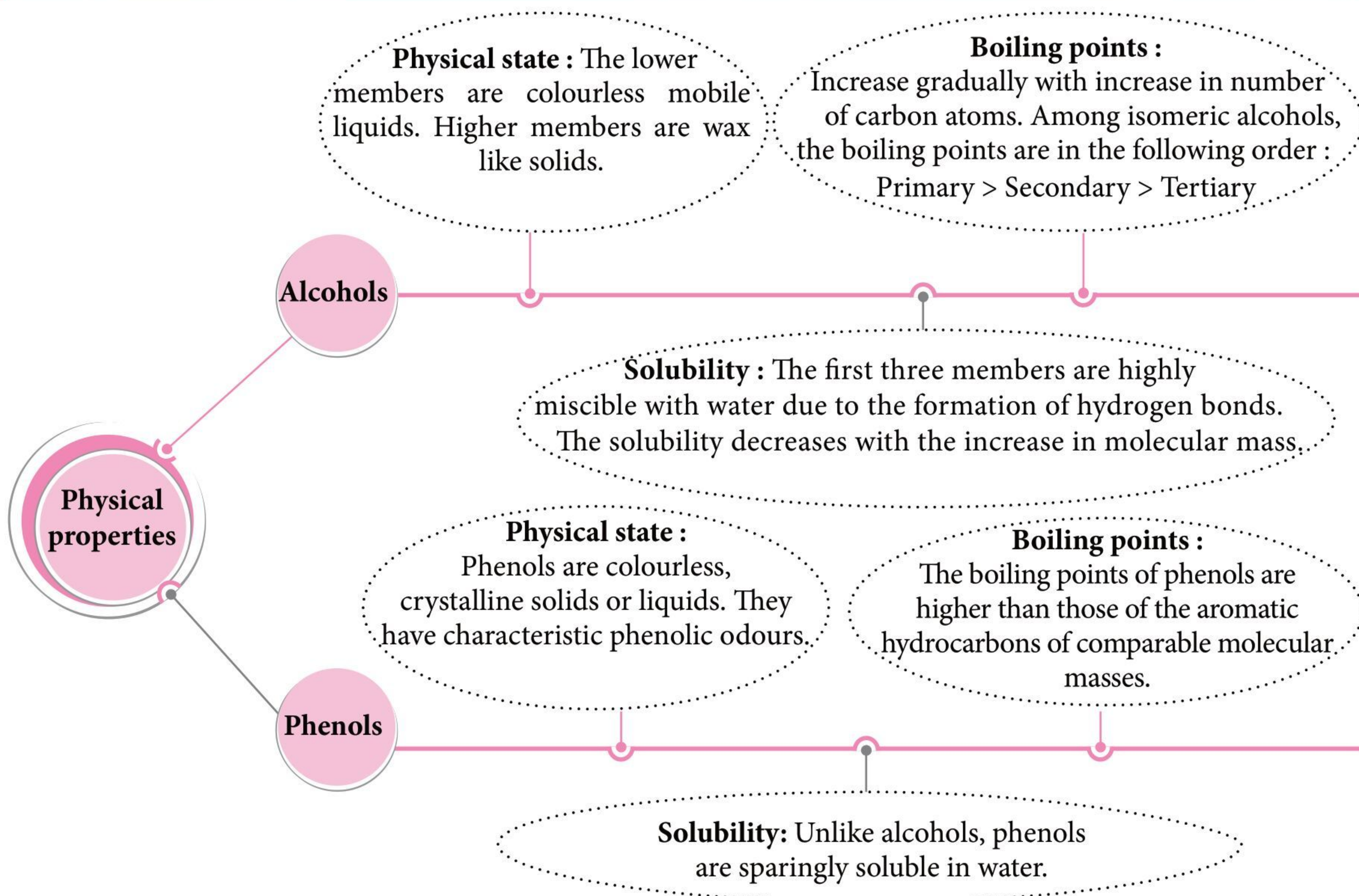
JEE Main



Now on your android Smart phones
with the same login of web portal.

Log on to test.pcmbtoday.com

PHYSICAL PROPERTIES OF ALCOHOLS AND PHENOLS



CHEMICAL PROPERTIES OF ALCOHOLS

A	$\xrightarrow{\text{Na}} \text{RONa} + \text{H}_2$
L	$\xrightarrow{\text{R'COOH}} \text{R'COOR} + \text{H}_2\text{O}$
	$\xrightarrow{\text{RCOCl}} \text{RCOOR} + \text{HCl}$
C	$\xrightarrow{(\text{RCO})_2\text{O}} \text{RCOOR} + \text{RCOOH}$
O	$\xrightarrow{\text{R'MgX}} \text{R'H} + \text{Mg(OR)X}$
H	$\xrightarrow{\text{HX}} \text{RX} + \text{H}_2\text{O}$
O	$\xrightarrow{\text{PX}_3} \text{RX} + \text{H}_3\text{PO}_3$
L	$\xrightarrow{\text{PCl}_5} \text{RCl} + \text{POCl}_3 + \text{HCl}$

A	$\xrightarrow{\text{SOCl}_2} \text{RCl} + \text{SO}_2 + \text{HCl}$
L	$\xrightarrow[443 \text{ K}]{\text{Conc. H}_2\text{SO}_4} \text{RCH=CH}_2 + \text{H}_2\text{O}$
C	$\xrightarrow[413 \text{ K}]{\text{Conc. H}_2\text{SO}_4} \text{ROR} + \text{H}_2\text{O}$
O	$\xrightarrow[\text{or KMnO}_4/\text{OH}^-]{\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+} \text{R-COOH}$
H	$\xrightarrow[-\text{H}_2]{\text{Cu/573 K}} \text{RCHO or RCOR or alkene}$ (from 1° alcohol) (from 2° alcohol) (from 3° alcohol)
O	$\xrightarrow{\text{PCC}} \text{RCHO}$
L	$\xrightarrow[\text{or CrO}_3 \cdot \text{C}_5\text{H}_5\text{N} \cdot \text{HCl}]{\text{PCC}} \text{RCHO}$

Distinction

- Lucas test :** Lucas reagent is a solution of conc. HCl with anhyd. ZnCl_2 . With Lucas reagent, observed
 - Primary alcohols – No cloudiness.
 - Secondary alcohols – Cloudiness in 5 minutes.
 - Tertiary alcohols – Cloudiness immediately.



10 Very Similar Practice Tests **JEE Main**



₹ 200/-



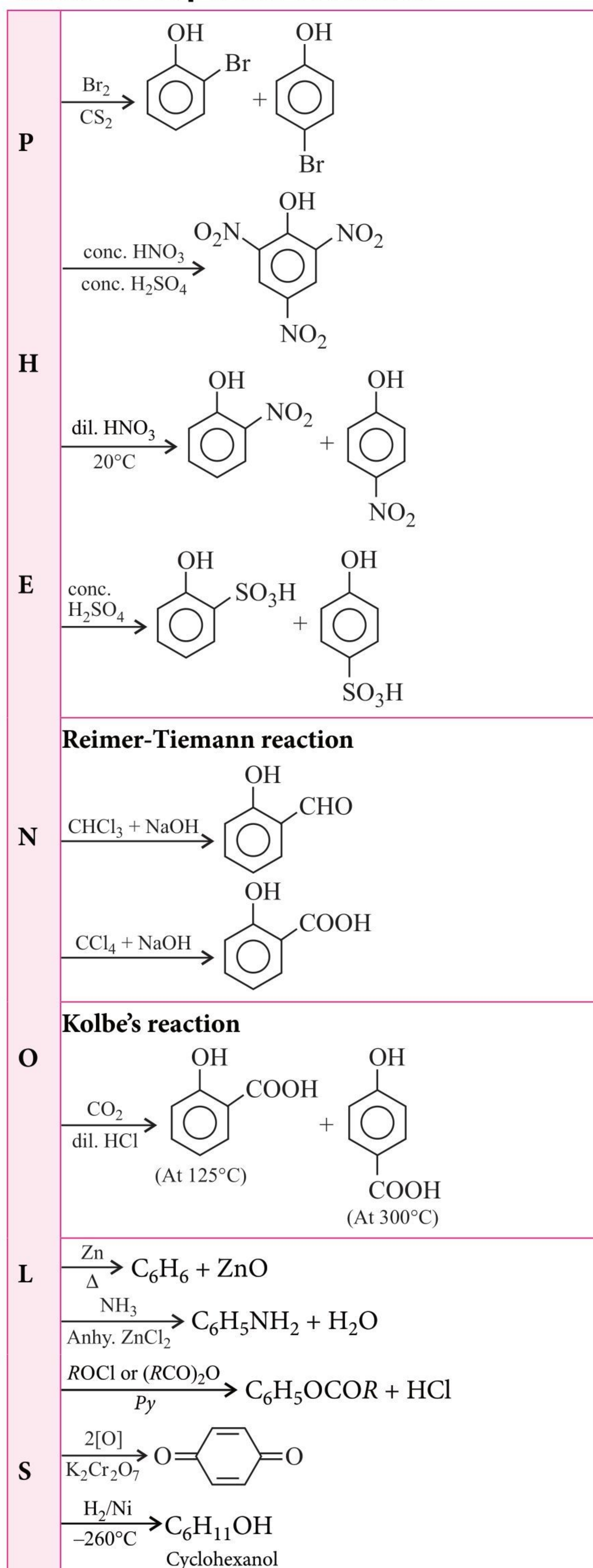
HIGHLIGHTS

- 10 Very Similar Practice Tests as per the latest pattern of NTA JEE Main (60 MCQs+ 30 Numerical Value Type Questions)
- OMR sheet provided at the end of each test
- Detailed solutions of each practice test included

Available at all leading book shops throughout India. To buy online visit www.mtg.in. For more information or for help in placing your order, call 0124-6601200, 1800-10-38673 (Toll Free) or e-mail info@mtg.in

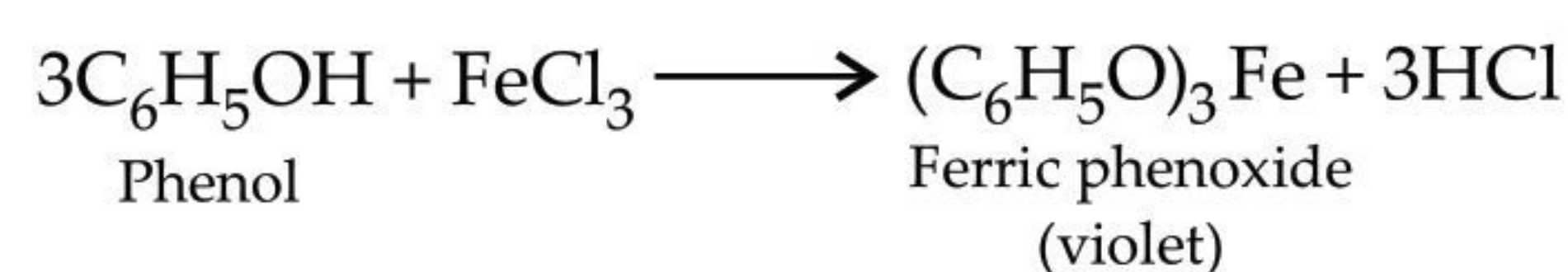
Also available on
Flipkart, Snapdeal, Amazon,
Infibeam on cash on delivery

Chemical Properties Of Phenols

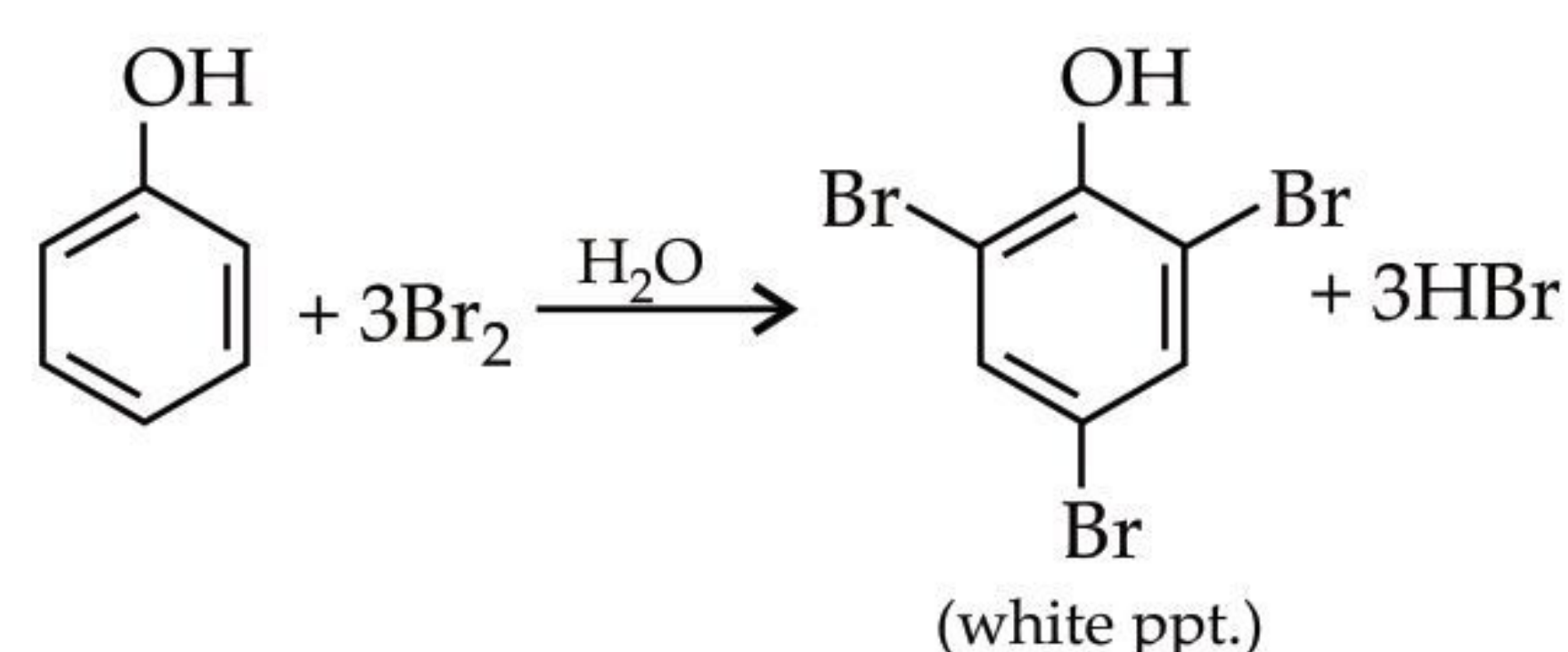


Distinguishing Test Between Alcohols and Phenol

Ferric chloride test : Though both phenol and alcohols are hydroxyl compounds, some of their properties are different. Phenol is weakly acidic in nature and turns blue litmus paper red. Alcohols are almost neutral and have no action on litmus paper. When treated with aqueous neutral ferric chloride solution, phenol gives violet colour while alcohols do not give violet colour.



- **Bromine water test** : Phenol gives white ppt. with Br_2 -water due to the formation of 2, 4, 6-tribromophenol.



ETHERS

- Substitution of a hydrogen atom in a hydrocarbon by an alkoxy or aryloxy group ($R - O/Ar - O$) yields 'ether' having general formula $C_nH_{2n+2}O$ ($n > 1$).

- ➡ **Simple or symmetrical :** Having same R attached to O atom
e.g., $C_2H_5OC_2H_5$

- Mixed or unsymmetrical:**
Two *R* groups are different
e.g., $\text{C}_2\text{H}_5\text{OC}_3\text{H}_7$

Classification

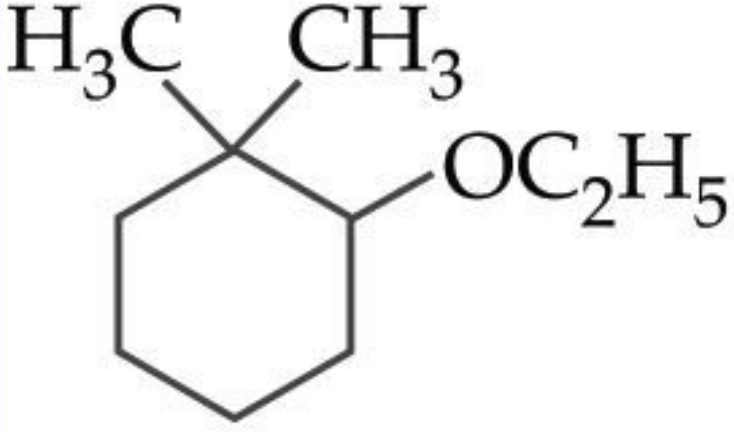
- ➡ **Aliphatic ethers** : R and R' are both alkyl groups.

- e.g.*, $\text{CH}_3\text{—O—CH}_2\text{CH}_3$

- **Aromatic ethers** : Either one or both R and R' are aryl groups.
e.g., $\text{C}_6\text{H}_5\text{—O—CH}_3$

NOMENCLATURE

Compound	Common name	IUPAC name
$\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$	Diethyl ether	Ethoxyethane

$\text{CH}_3\text{OCH}_2\text{CH}_2\text{CH}_3$	Methyl <i>n</i> -propyl ether	1-Methoxypropane
$\text{C}_6\text{H}_5\text{OCH}_2\text{CH}_3$	Ethyl phenyl ether (Phenetole)	Ethoxybenzene
$\text{C}_6\text{H}_5\text{O}(\text{CH}_2)_6\text{CH}_3$	Heptyl phenyl ether	1-Phenoxyheptane
$\text{CH}_3\text{O}-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_3$	Methyl isopropyl ether	2-Methoxypropane
$\text{CH}_3\text{O}(\text{CH}_2)_2\text{OCH}_3$	—	1,2-Dimethoxyethane
	—	2-Ethoxy-1,1- dimethylcyclohexane

Nomenclature Isomerism

Isomerism

Functional

- (i) $\text{CH}_3-\text{O}-\text{CH}_3$
Dimethyl ether
- (ii) $\text{CH}_3-\text{CH}_2-\text{OH}$
Ethyl alcohol

Chain

- (i) $\text{CH}_3-\text{O}-\text{C}_5\text{H}_{11}$
Methoxy pentane
- (ii) $\text{CH}_3-\text{O}-\text{CH}_2-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_2-\text{CH}_3$
1-Methoxy-2-methylbutane

Metamerism

Attachment of different alkyl groups.

- (i) $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
- (ii) $\text{CH}_3\text{OCH}_2\text{CH}_2\text{CH}_3$
- (iii) $\text{CH}_3-\text{O}-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_3$

Physical Properties

Physical properties

Physical state : Dimethyl ether and ethyl methyl ether are exceptionally gases at room temperature whereas all other ethers are colourless liquids with characteristic ethereal smell.

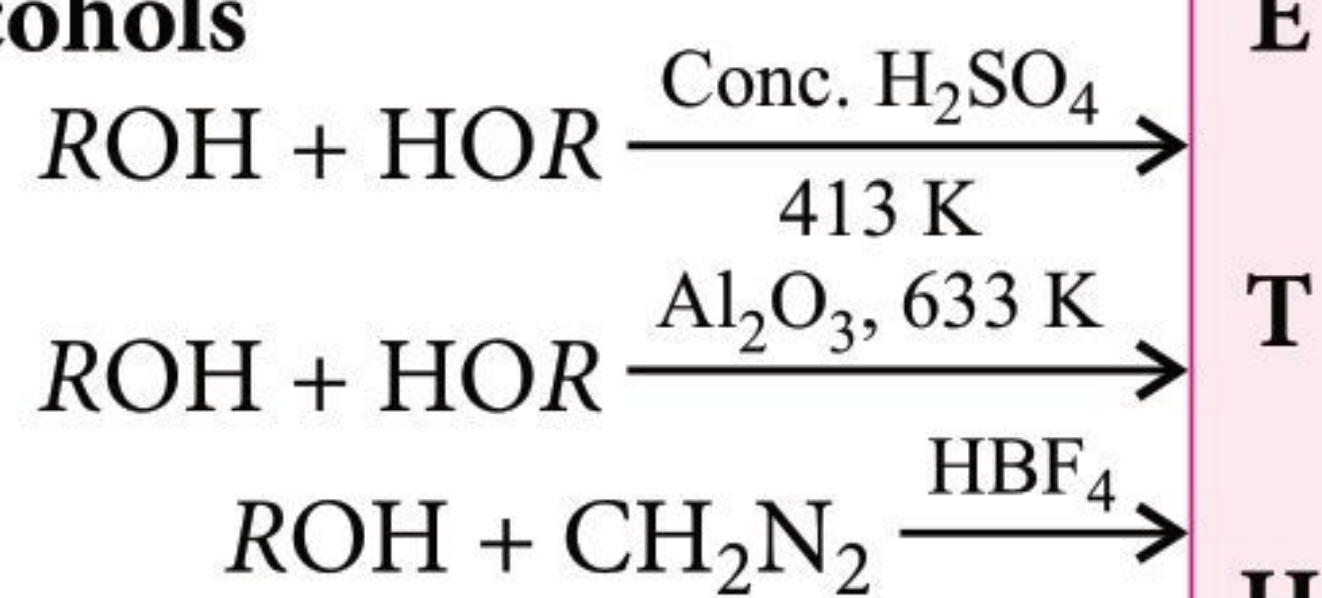
Solubility : Ethers are soluble in water to a certain extent due to hydrogen bonding. However, solubility decreases with increase of molecular mass *i.e.*, increase in the hydrocarbon part.

Boiling points : Ethers have lower boiling points than isomeric alcohols due to their inability to form hydrogen bonds and get associated.

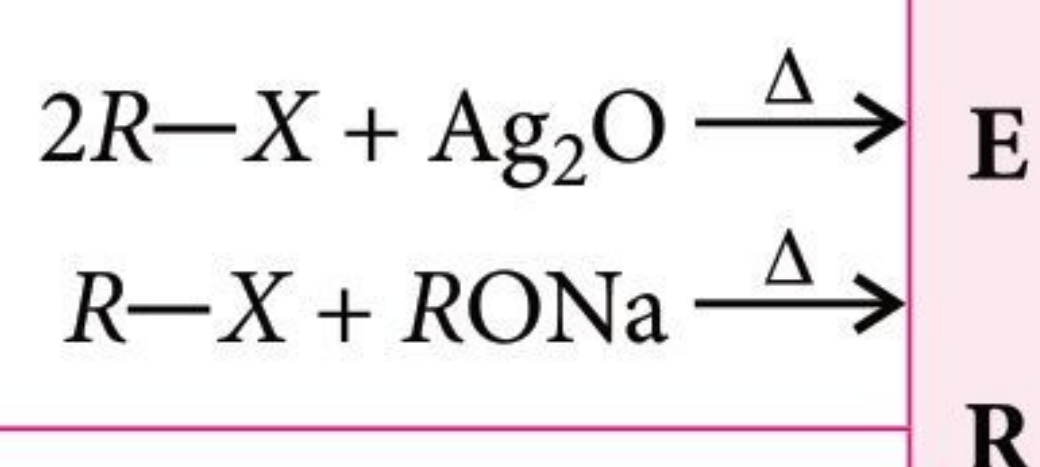
Dipole moment : Ethers are polar in nature with a dipole moment varying from 1.15 D to 1.30 D. Since ethers have a bent structure, the polarities of two C—O bonds do not cancel each other.

Methods of Preparation

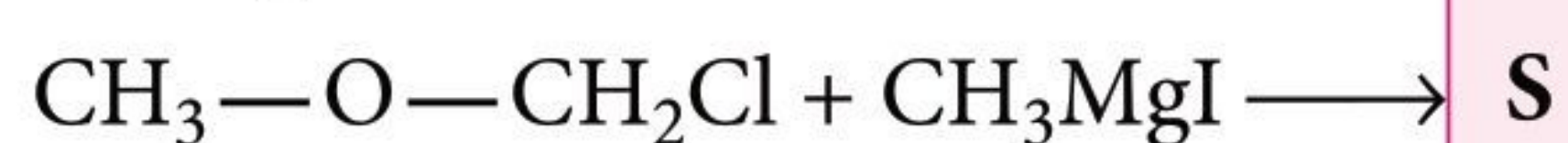
By dehydration of alcohols



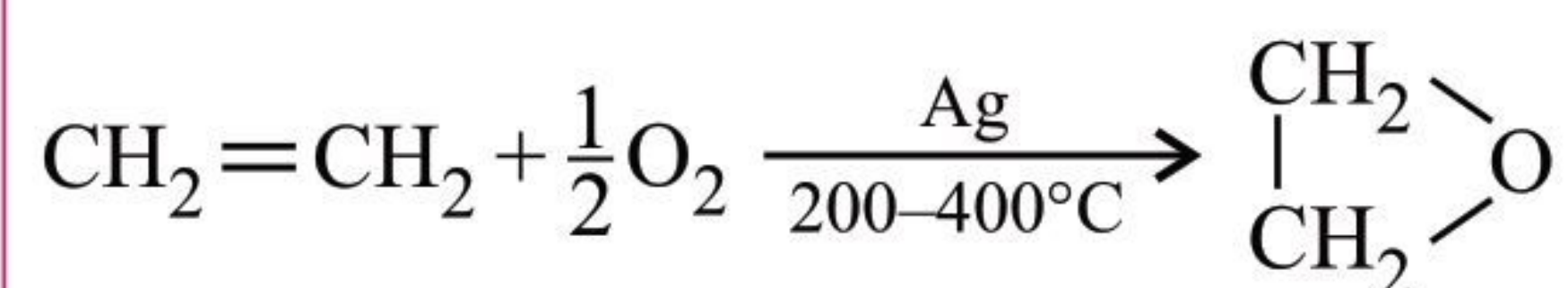
From alkyl halides



From Grignard reagent

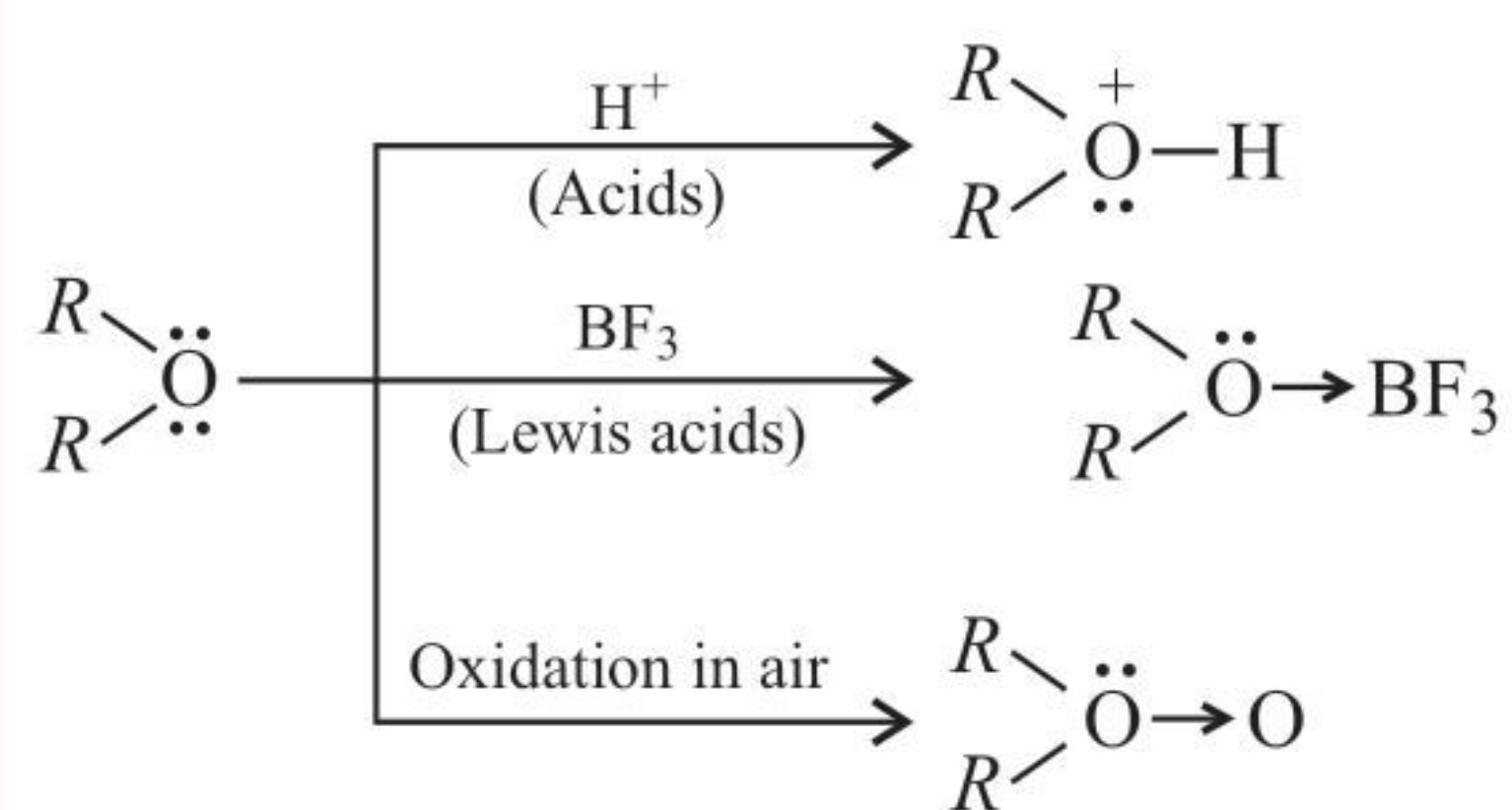


Preparation of cyclic ethers (or epoxides)

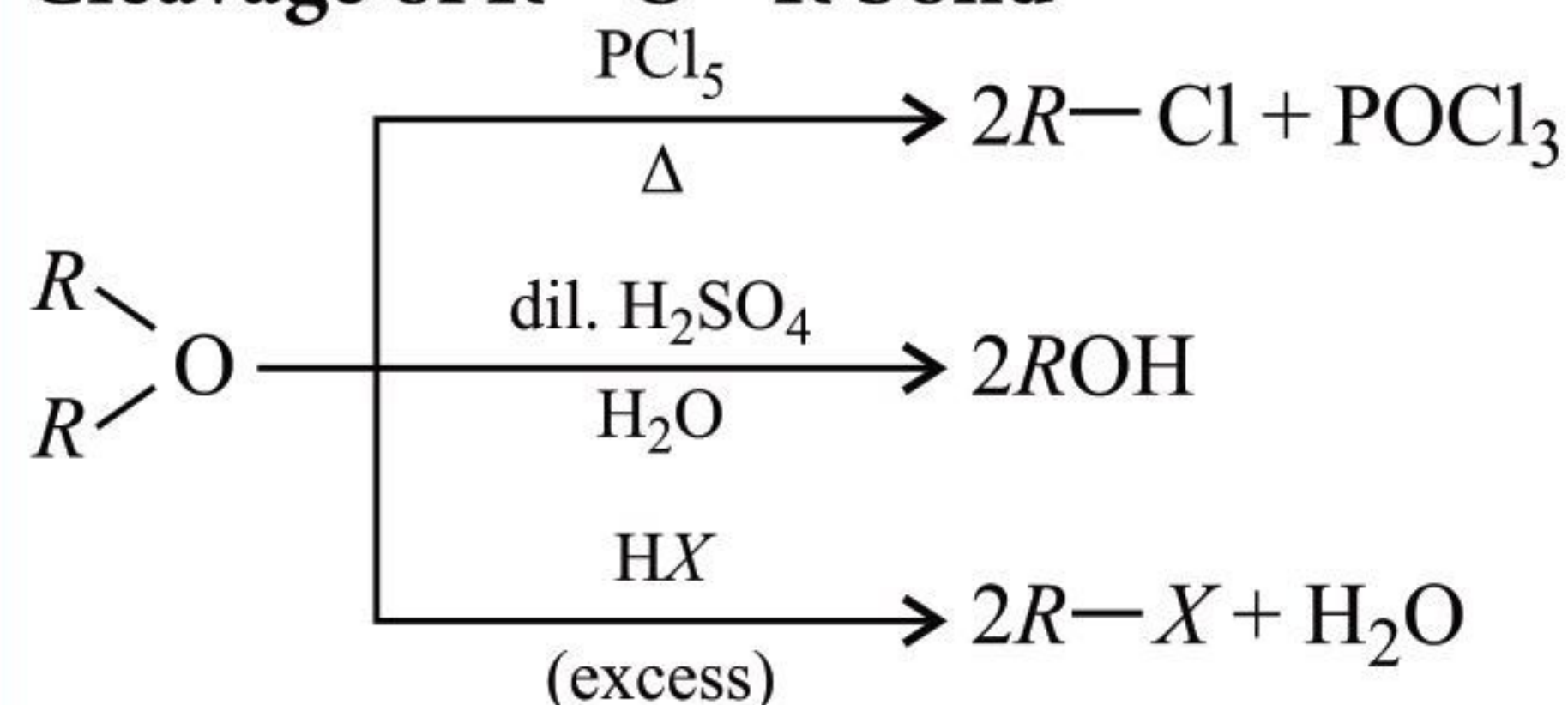


Chemical Properties

Reactions of lone pair of oxygen



Cleavage of R—O—R bond



Uses of diethyl ether

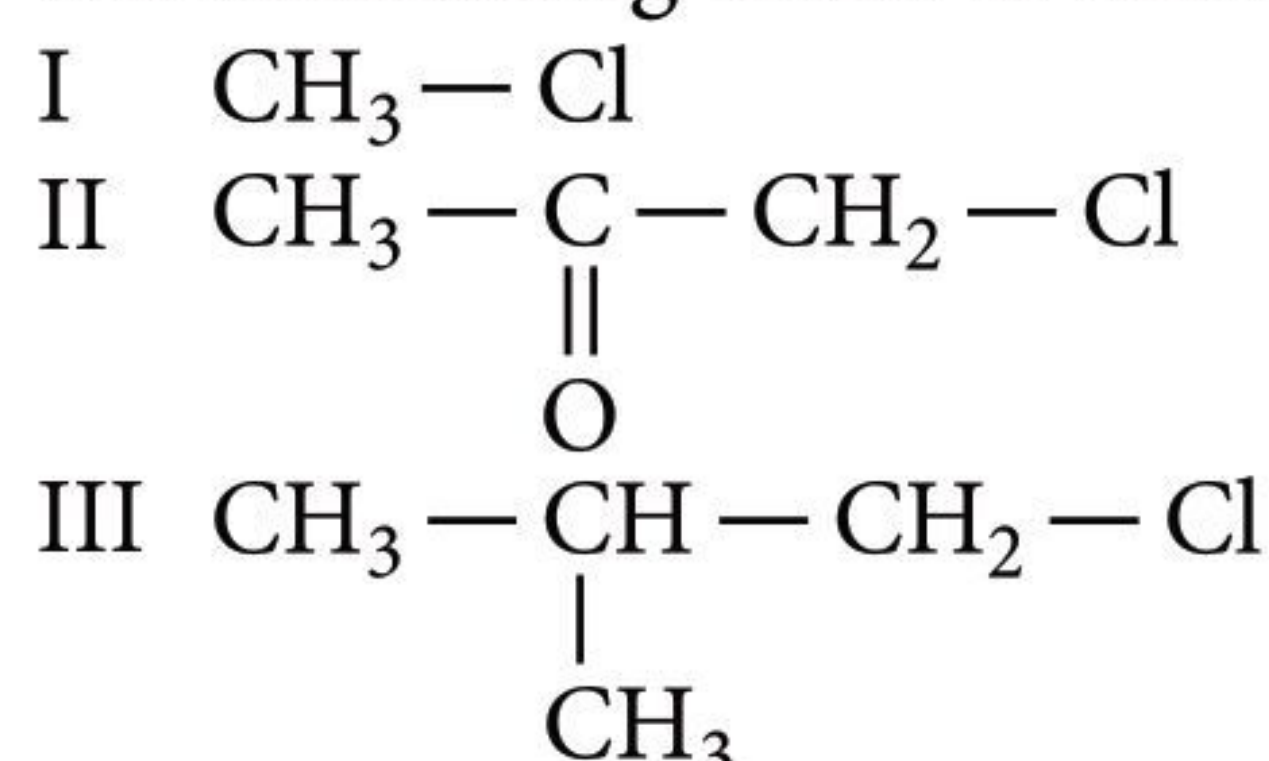
- Diethyl ether is used as industrial solvent for oils, fats, gum, resin etc.
- It is used as solvent in the reaction of Grignard reagent.
- It is used as refrigerant.
- A mixture of diethyl ether and ethyl alcohol, known as *Natalite*, is used as fuel (substitute of petrol).



WRAP it up!

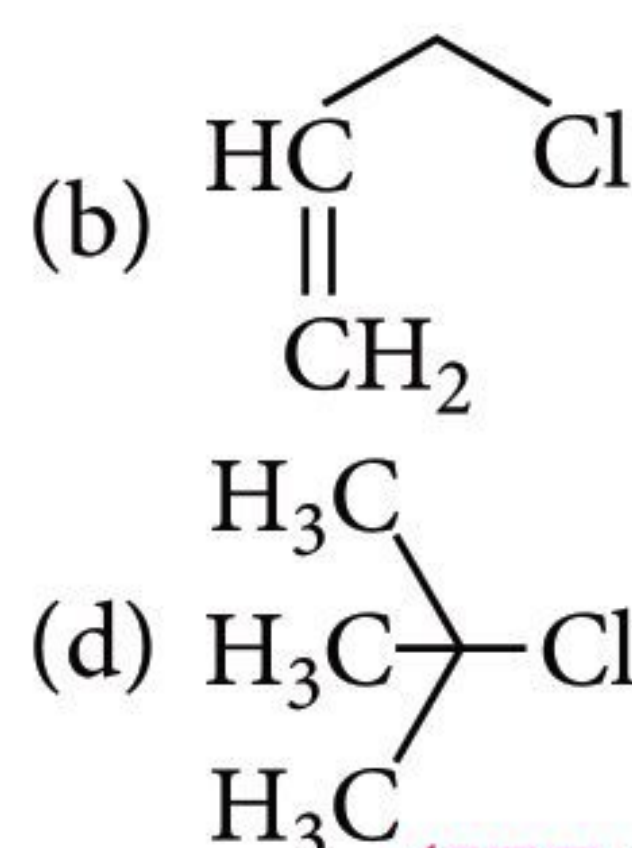
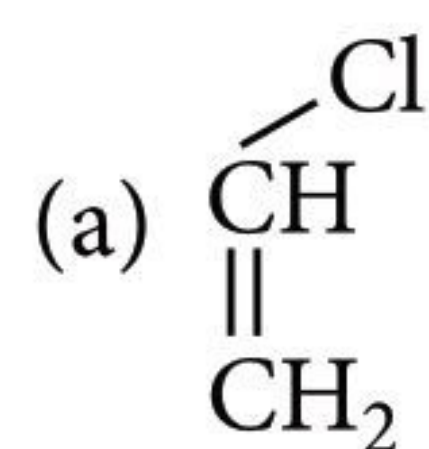
MCQs Type

1. The decreasing order of rate of S_N2 reaction is



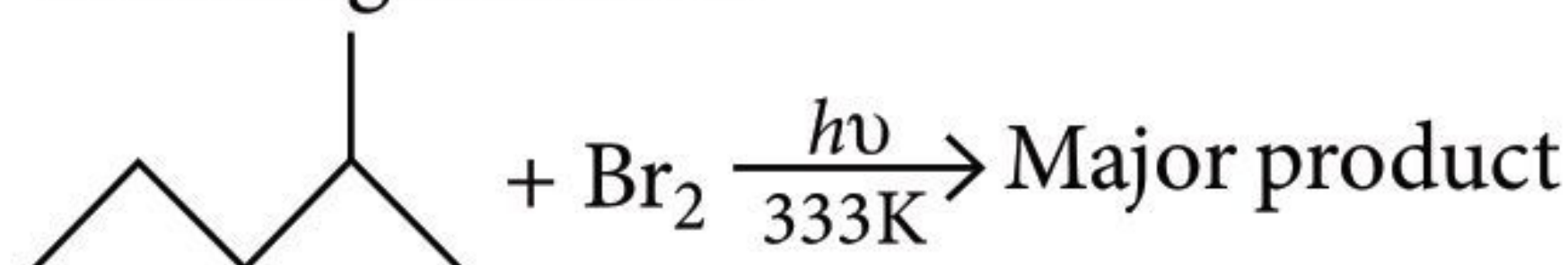
- (a) IV > III > II > I (b) II > III > I > IV
 (c) II > I > IV > III (d) none of these.

2. Among the following compounds, which one has the shortest C—Cl bond?



(JEE Main 2020)

3. Which of the following is the major product of the following reaction?



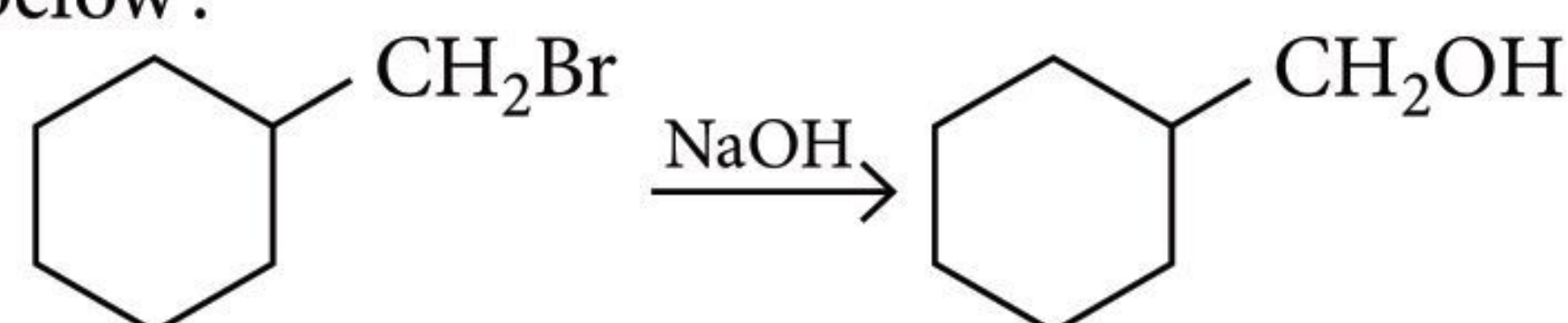
- (a) 3-Bromo-2-methylpentane
 (b) 2-Bromo-2-methylpentane
 (c) 1-Bromo-2-methylpentane
 (d) 4-Bromo-2-methylpentane

4. The aerial oxidation of chloroform in sunlight to phosgene can be checked by
 (a) keeping chloroform in coloured bottles but not completely filled
 (b) adding a few drops of 1% $\text{C}_2\text{H}_5\text{OH}$

- (c) adding a few drops of dil. HCl or NaOH
 (d) both (a) and (b).

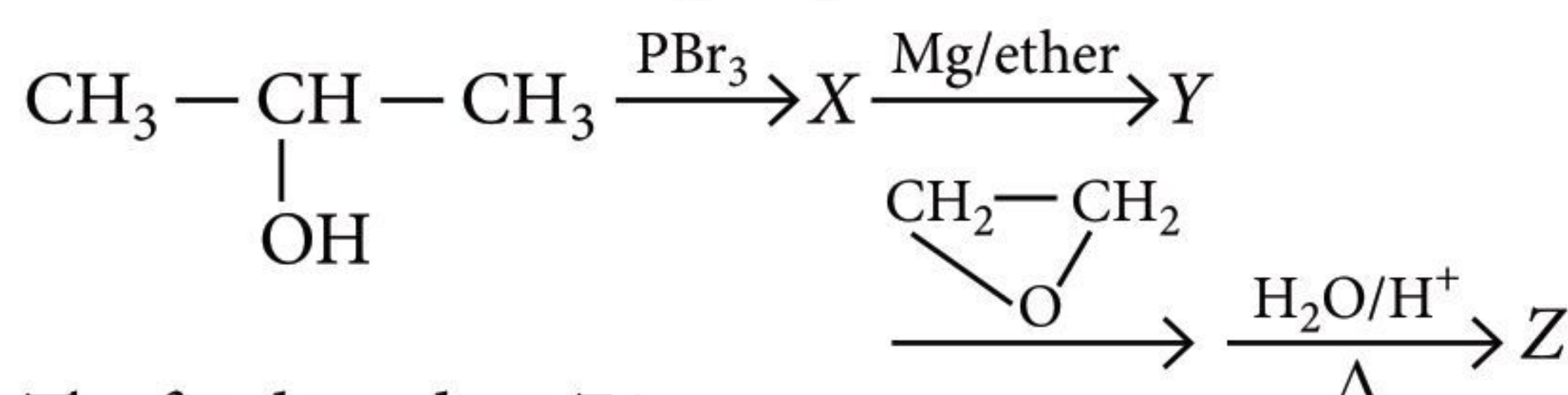
5. The conversion of *m*-nitrophenol to resorcinol involves respectively
 (a) hydrolysis, diazotization and reduction
 (b) diazotization, reduction and hydrolysis
 (c) hydrolysis, reduction and diazotization
 (d) reduction, diazotization and hydrolysis.

6. Suggest the suitable solvent for the reaction given below:



- (a) H_2O (b) $\text{C}_2\text{H}_5\text{OH}$
 (c) HCONMe_2 (d) C_6H_6

7. Consider the following sequence of reactions.



The final product Z is

- (a) $\text{CH}_3-\text{CH}(\text{CH}_3)-\text{CH}_2\text{CH}_2\text{OH}$
 (b) $\text{CH}_3-\text{O}-\text{CH}(\text{CH}_3)-\text{CH}_2\text{CH}_3$
 (c) $\text{CH}_3-\text{CH}(\text{CH}_3)-\text{O}-\text{CH}_2-\text{CH}_3$
 (d) $\text{CH}_3-\text{CH}_2-\text{CH}(\text{CH}_3)-\text{CH}_2-\text{OH}$

8. The S_N1 reactivity of the following halides will be in the order
 (i) $(\text{CH}_3)_3\text{CBr}$ (ii) $(\text{C}_6\text{H}_5)_2\text{CHBr}$
 (iii) $(\text{C}_6\text{H}_5)_2\text{C}(\text{CH}_3)\text{Br}$ (iv) $(\text{CH}_3)_2\text{CHBr}$

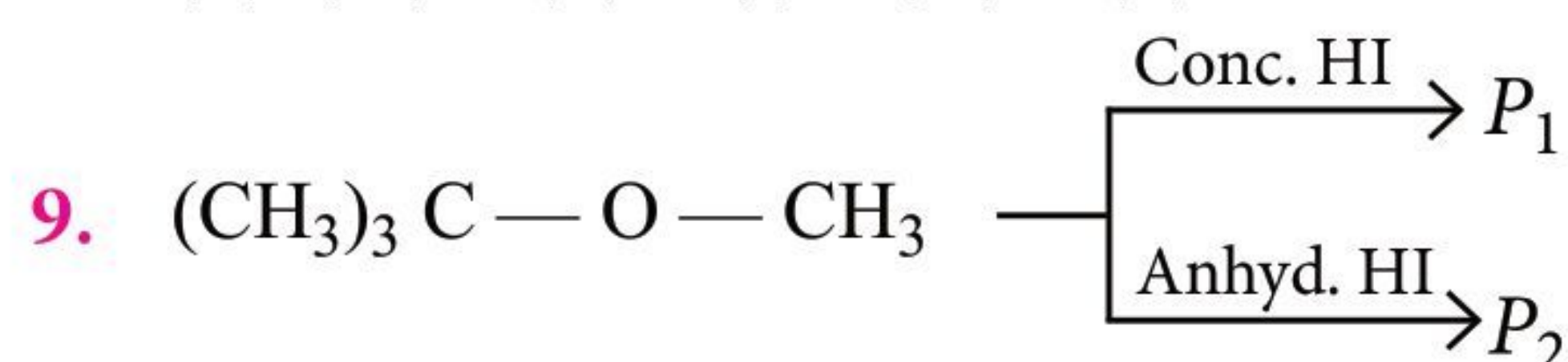
(v) C_2H_5Br

(a) (v) > (iv) > (i) > (ii) > (iii)

(b) (ii) > (i) > (iii) > (v) > (iv)

(c) (i) > (iii) > (v) > (ii) > (iv)

(d) (iii) > (ii) > (i) > (iv) > (v)



The products P_1 and P_2 are respectively

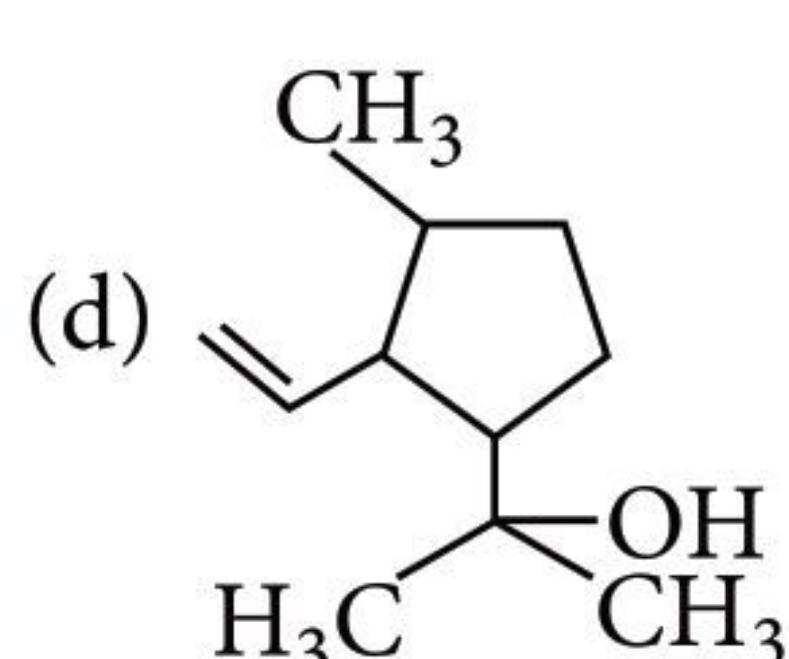
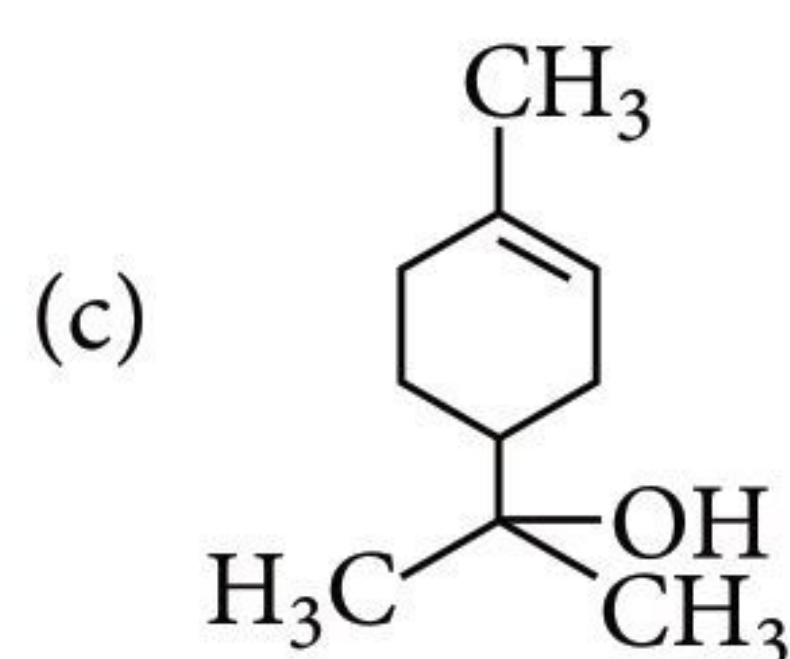
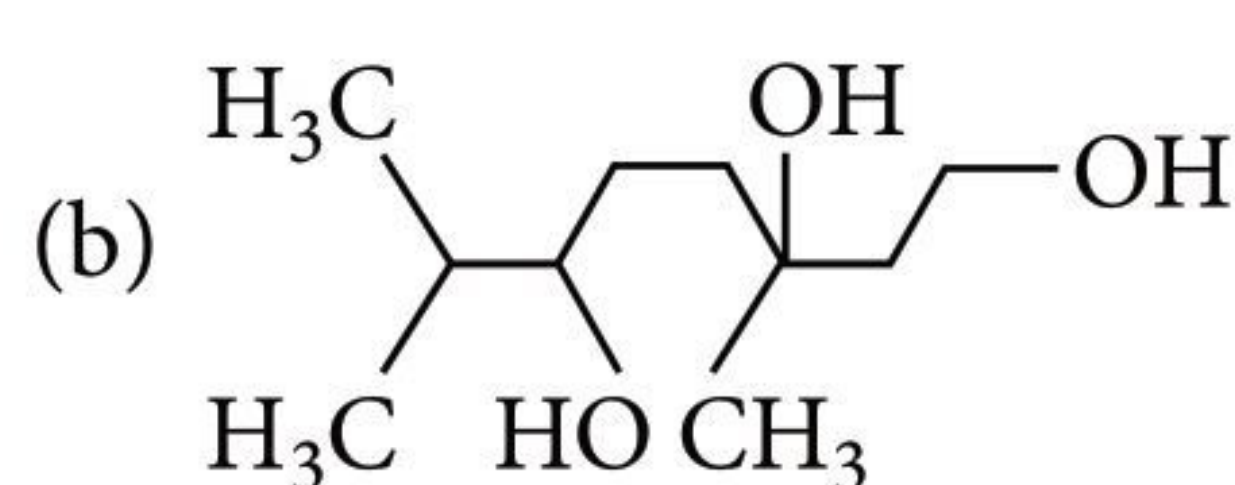
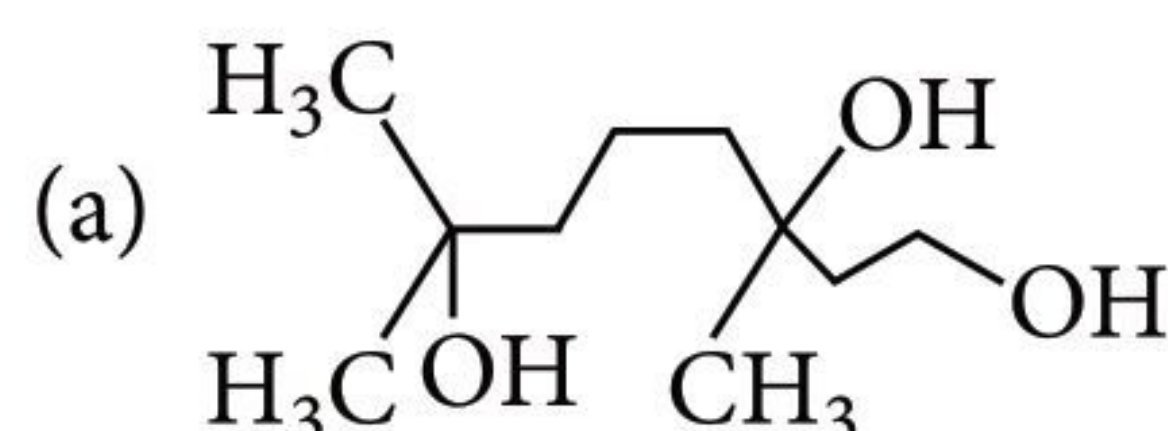
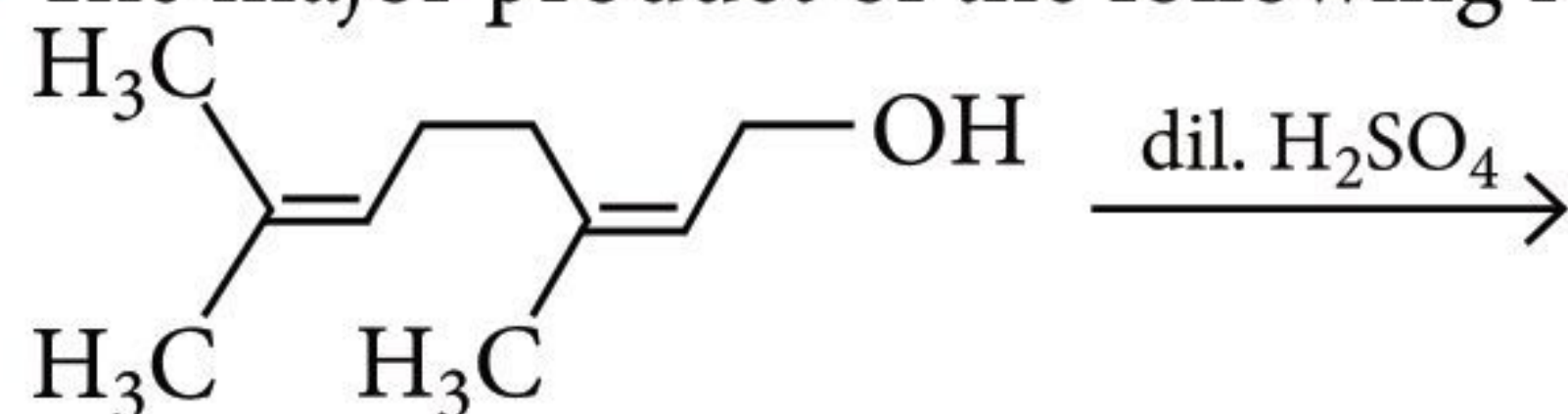
(a) $(CH_3)_3COH + CH_3I$ and $(CH_3)_3CI + CH_3OH$

(b) $(CH_3)_3CI + CH_3OH$ and $(CH_3)_3COH + CH_3I$

(c) $(CH_3)_3CI + CH_3OH$ in both cases

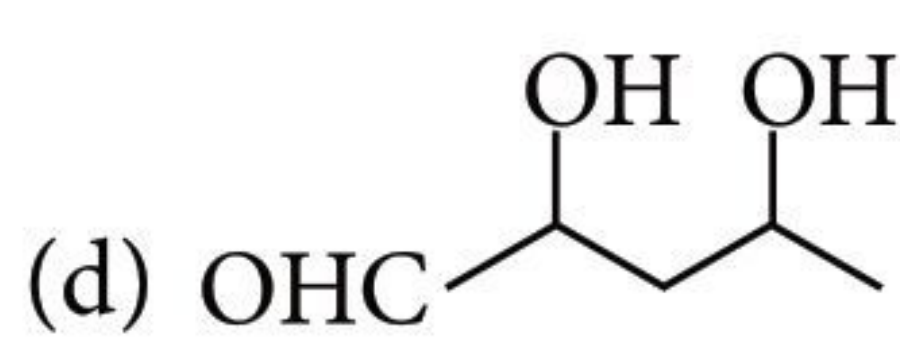
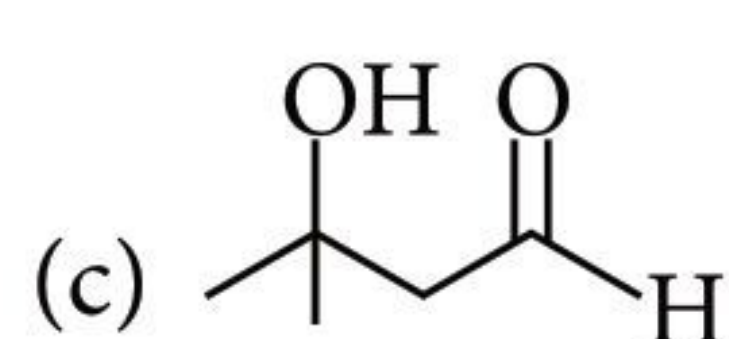
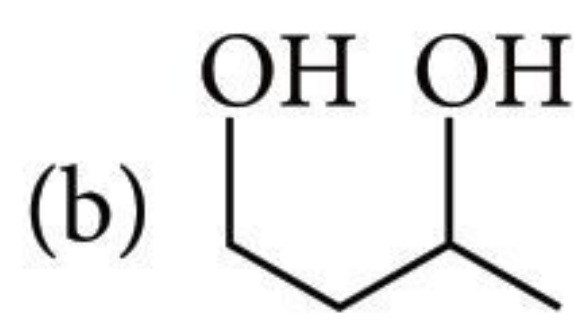
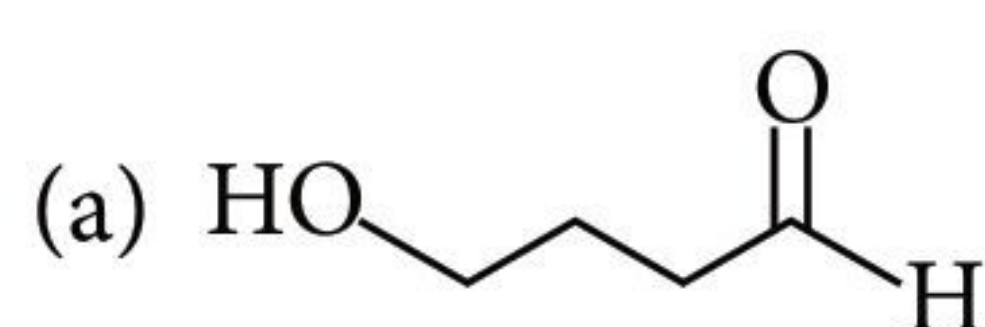
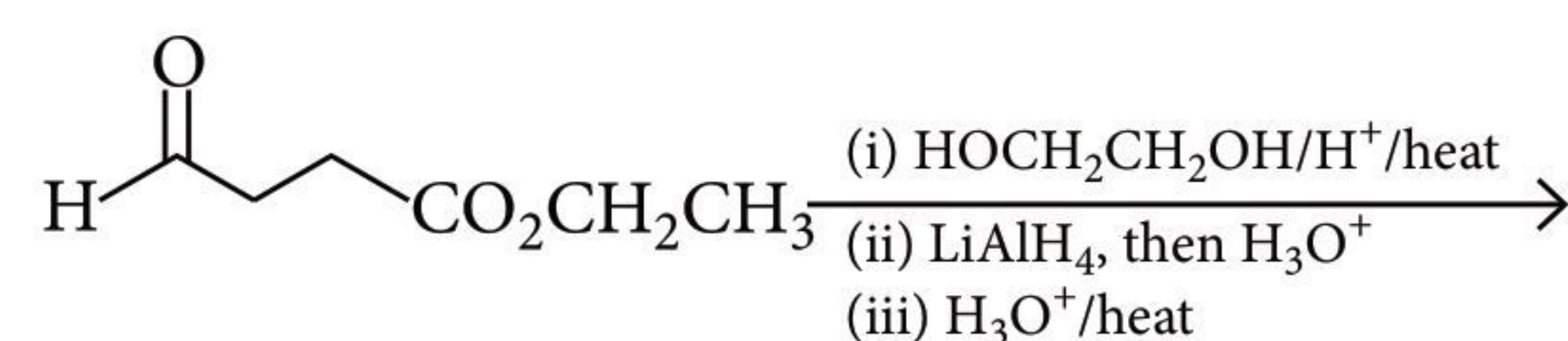
(d) CH_3I and $(CH_3)_3COH$ in both cases.

10. The major product of the following reaction is



(JEE Main 2020)

11. What will be the product of the given reaction?



12. The best method for the conversion of an alcohol into an alkyl chloride is by treating the alcohol with

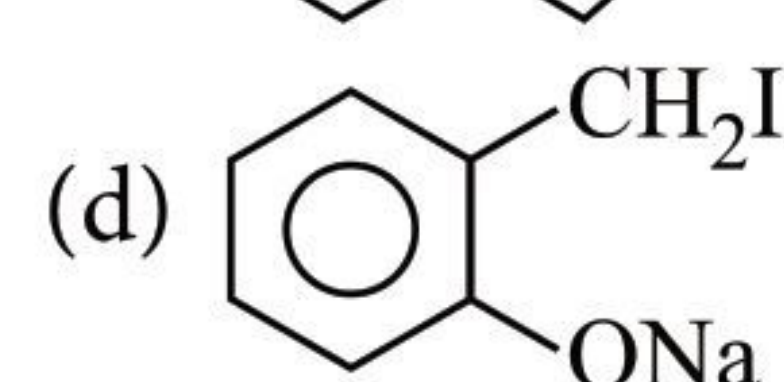
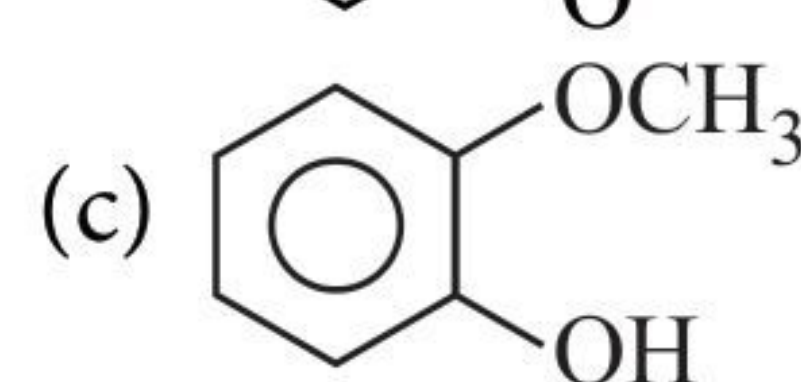
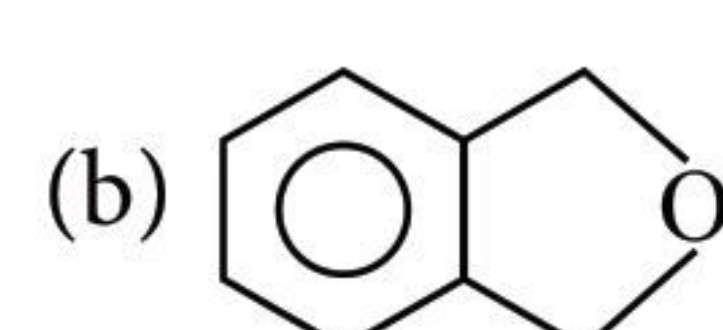
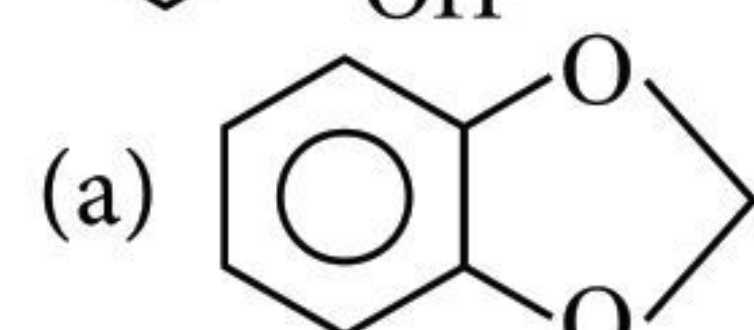
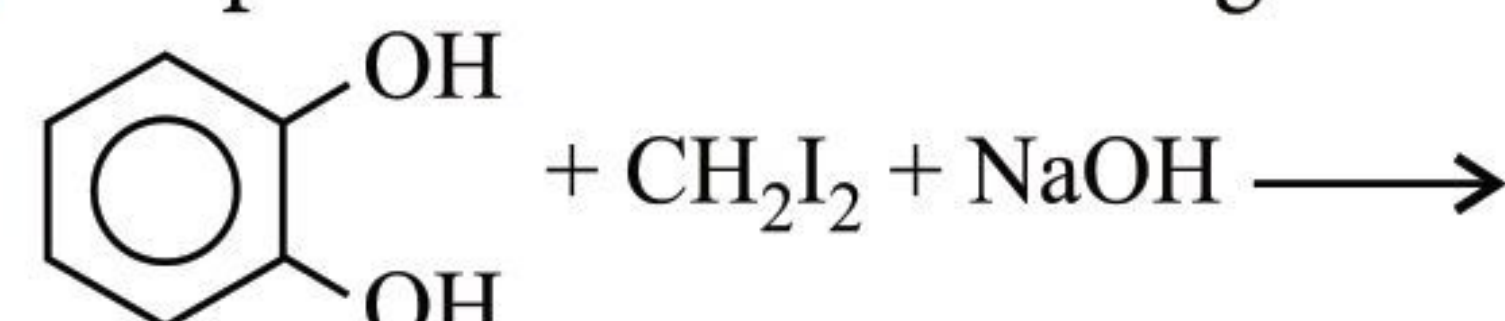
(a) PCl_5

(b) $SOCl_2$ in presence of pyridine

(c) Dry HCl in the presence of anhydrous $ZnCl_2$

(d) PCl_3 .

13. The product of the following reaction is



14. In Finkelstein reaction, which reactants are used

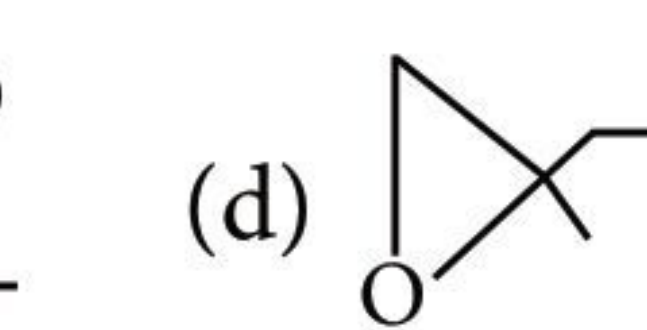
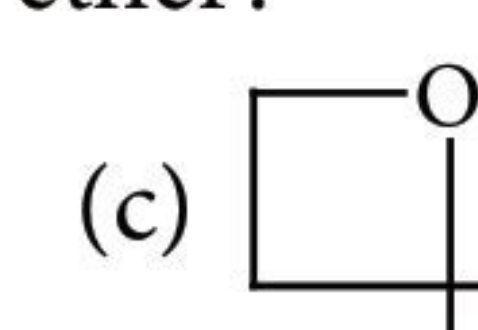
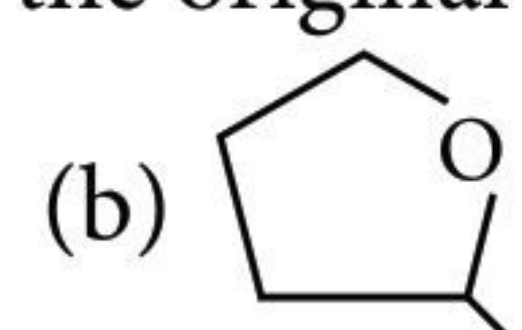
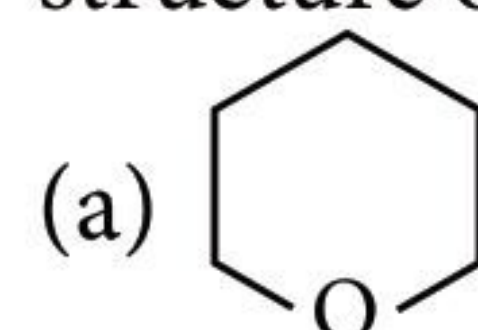
(a) $NaI + C_2H_5OH$

(b) $NaF + \text{acetone}$

(c) $NaBr + CH_3OH$

(d) $NaI + C_2H_5Br$.

15. A chiral ether $C_5H_{10}O$ reacts with hot HI to give a $C_5H_{10}I_2$ product. Treatment of this with hot KOH in ethanol produces 1, 3-pentadiene. What is the structure of the original ether?



16. Cumene process is the most important commercial method for the manufacture of phenol. Cumene is

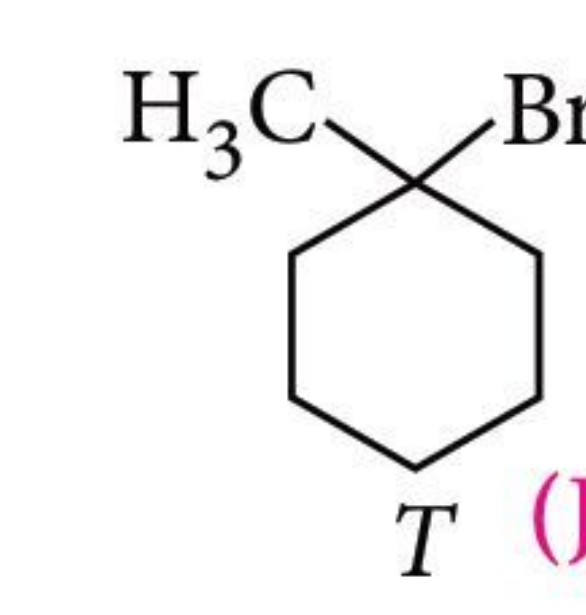
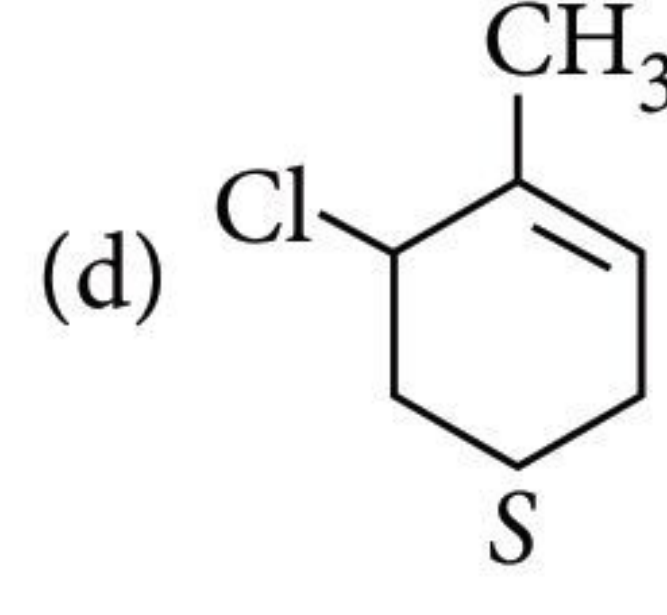
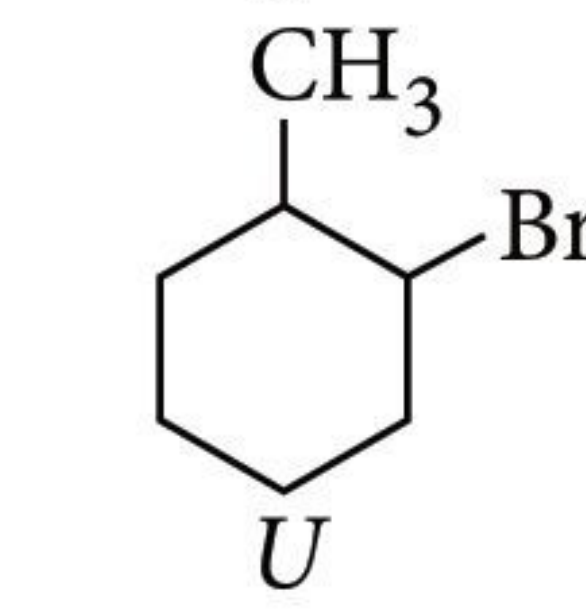
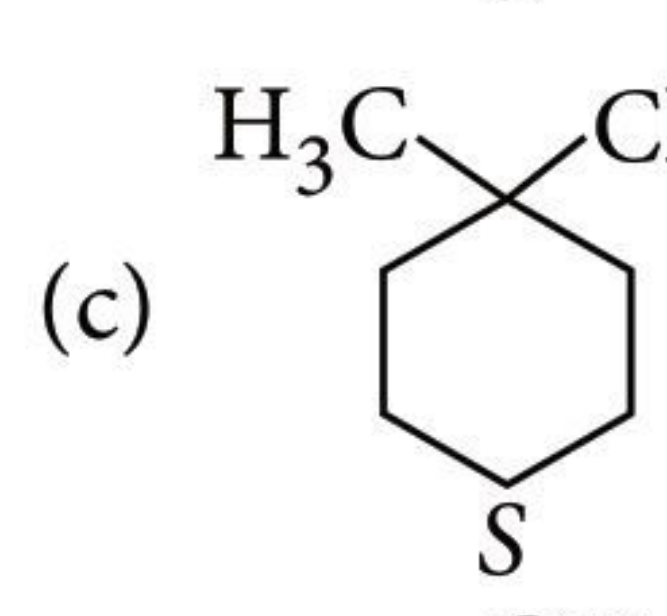
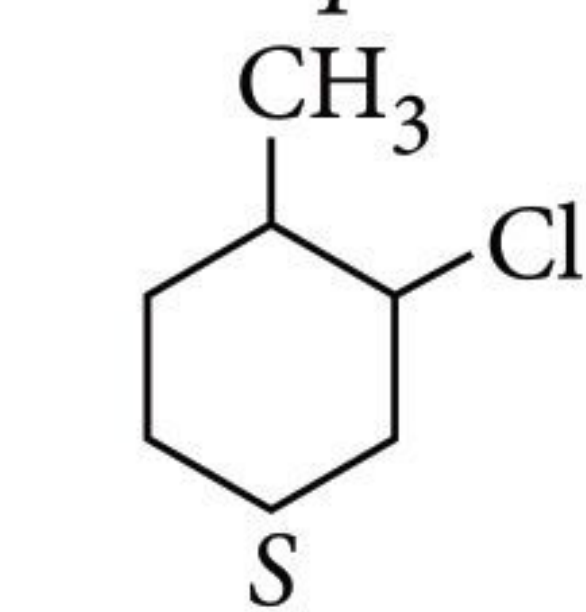
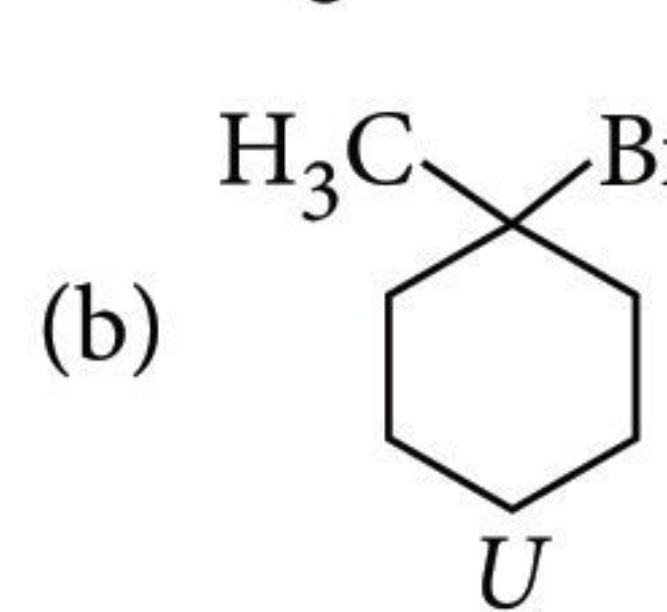
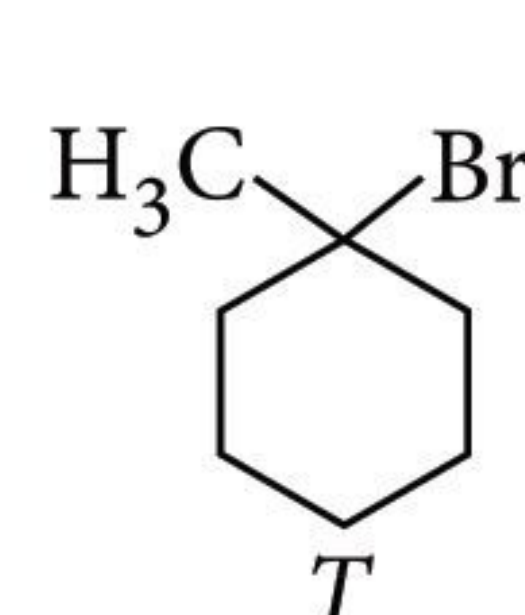
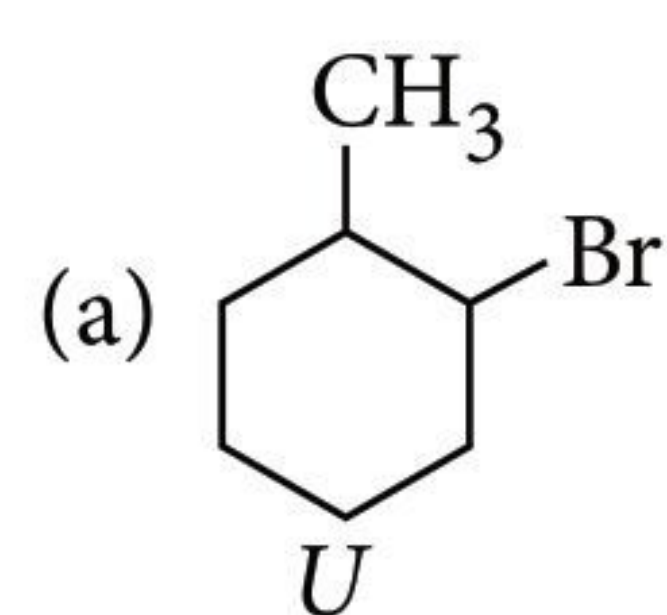
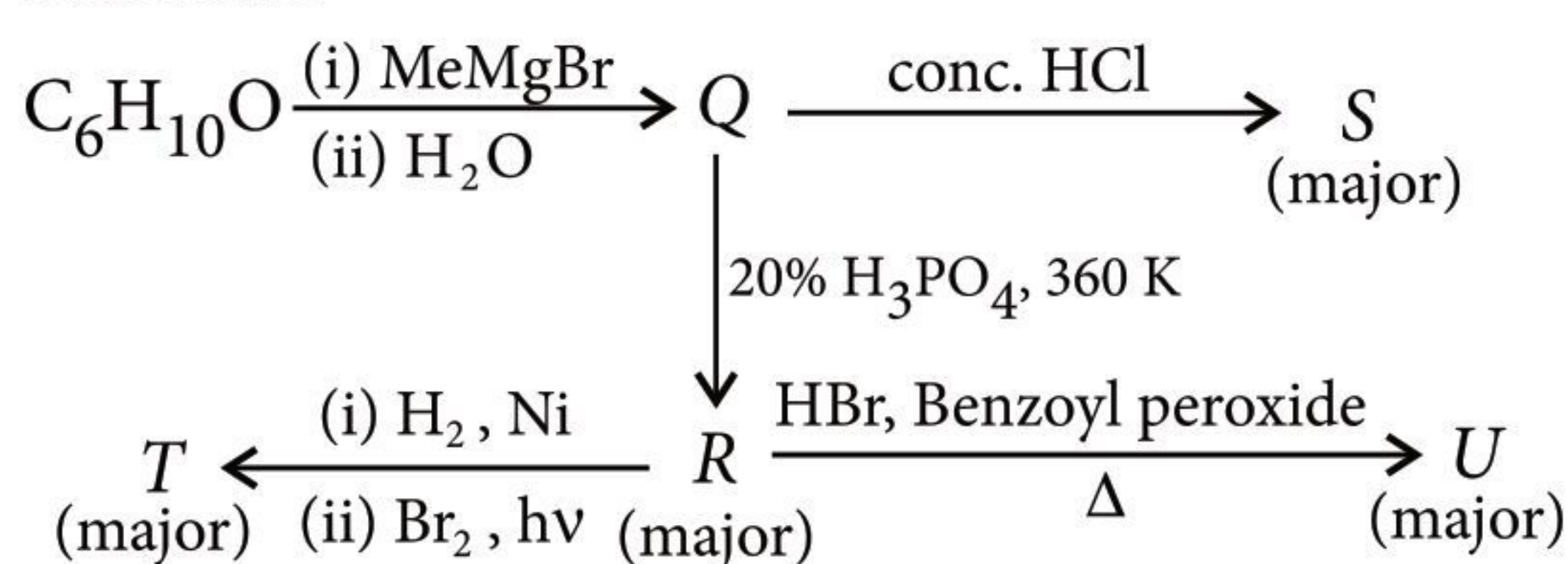
(a) *iso*-propyl benzene

(b) ethyl benzene

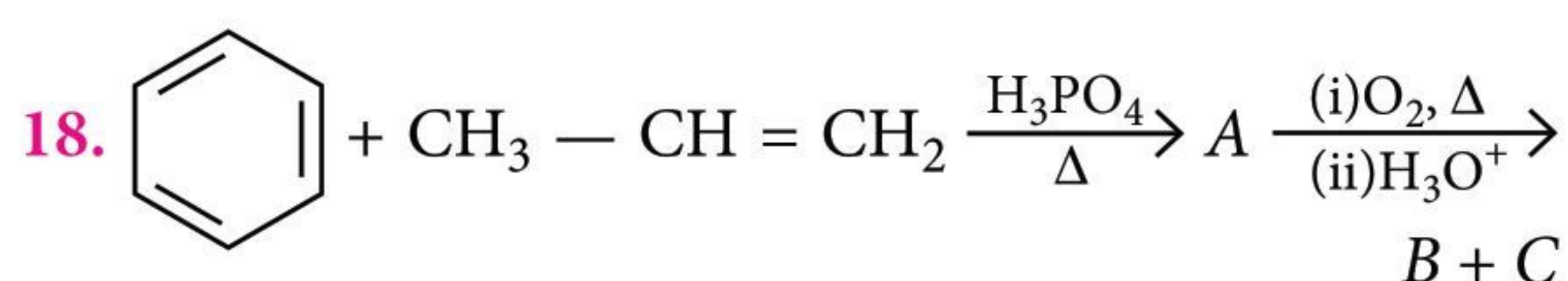
(c) vinyl benzene

(d) propyl benzene.

17. Choose the correct option(s) for the following set of reactions.



(JEE Advanced 2019)

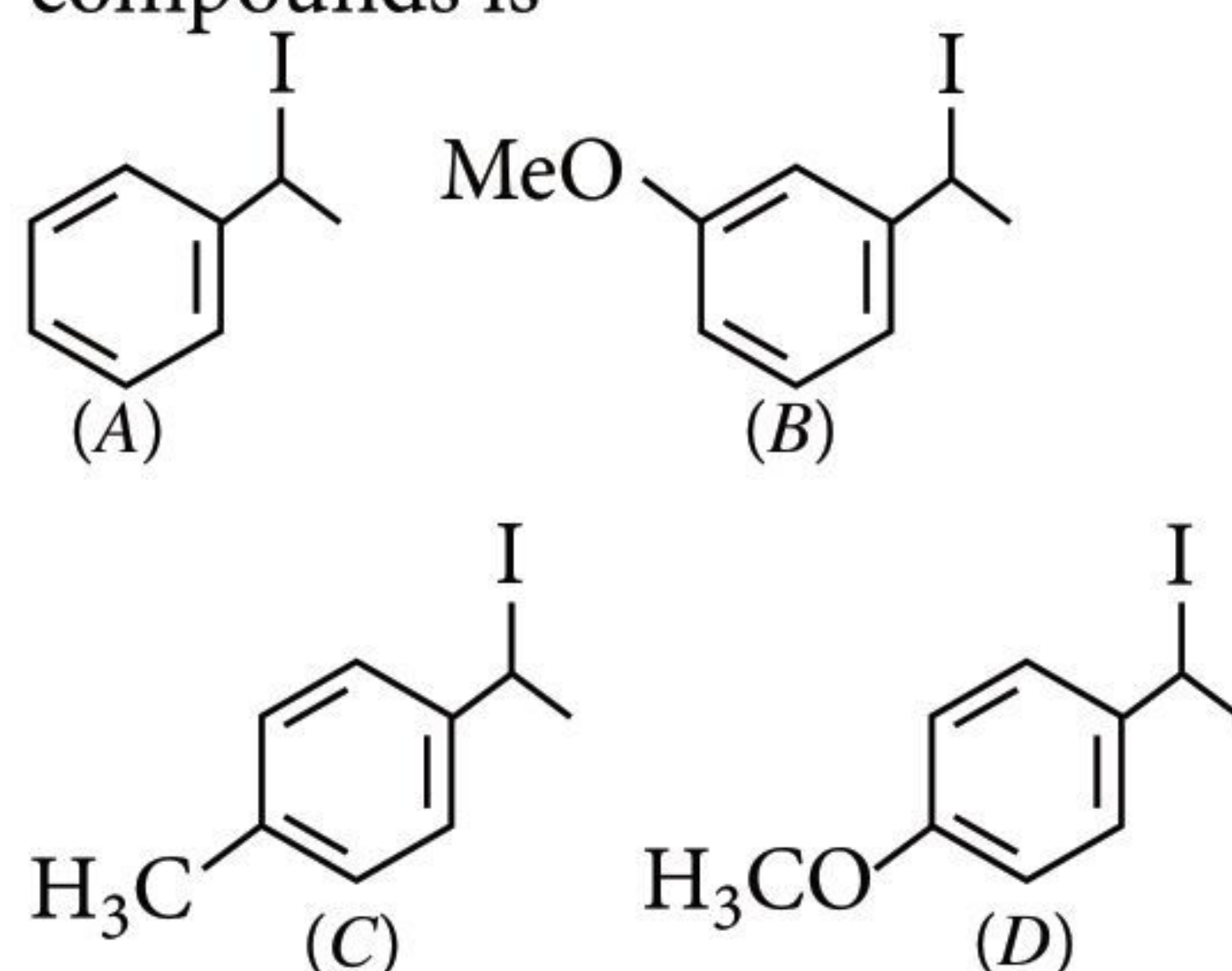


The products B and C are respectively

- (a) phenol and acetic acid
 (b) phenol and acetaldehyde
 (c) benzoic acid and acetone
 (d) phenol and acetone.
19. The correct sequence of bond enthalpy of 'C - X' bond is
- (a) CH₃ - Cl > CH₃ - F > CH₃ - Br > CH₃ - I
 (b) CH₃ - F < CH₃ - Cl < CH₃ - Br < CH₃ - I
 (c) CH₃ - F > CH₃ - Cl > CH₃ - Br > CH₃ - I
 (d) CH₃ - F < CH₃ - Cl > CH₃ - Br > CH₃ - I

(NEET 2021)

20. Increasing rate of S_N1 reaction in the following compounds is



- (a) (B) < (A) < (C) < (D)
 (b) (B) < (A) < (D) < (C)
 (c) (A) < (B) < (C) < (D)
 (d) (A) < (B) < (D) < (C)

(JEE Main 2019)

21. Elimination reaction of 2-bromopentane to form pent-2-ene is

- (A) β-Elimination reaction
 (B) follows Zaitsev rule
 (C) dehydrohalogenation reaction
 (D) dehydration reaction.

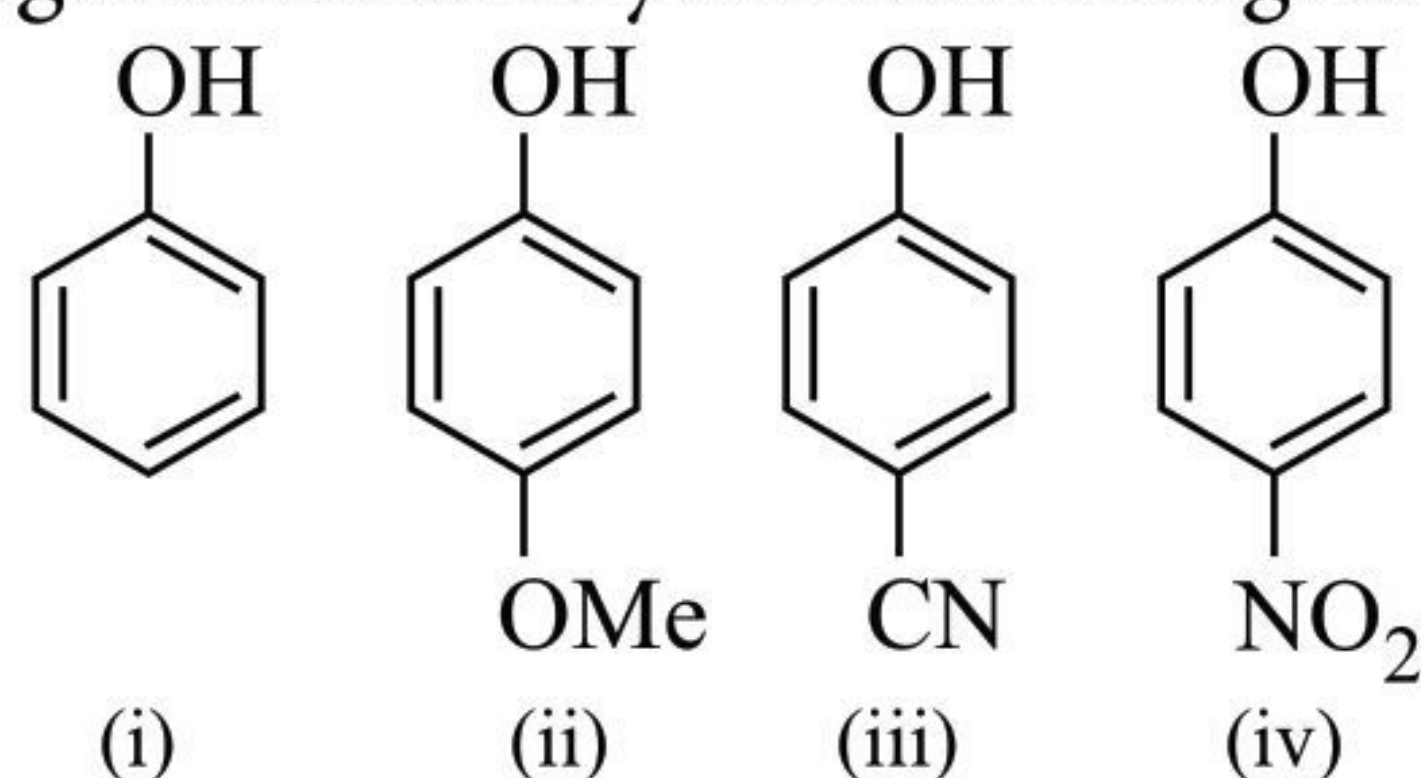
- (a) (A), (B), (C) (b) (A), (C), (D)
 (c) (B), (C), (D) (d) (A), (B), (D)

(NEET 2020)

22. Zeisel method is used to estimate

- (a) alcoholic group (b) amino group
 (c) methoxy group (d) halo group.

23. Which of the following represents the correct decreasing order of acidity of the following compounds?



- (a) (ii) > (i) > (iii) > (iv) (b) (iv) > (iii) > (ii) > (i)
 (c) (iii) > (iv) > (i) > (ii) (d) (iv) > (iii) > (i) > (ii)

24. Alkyl halides are less soluble in water because

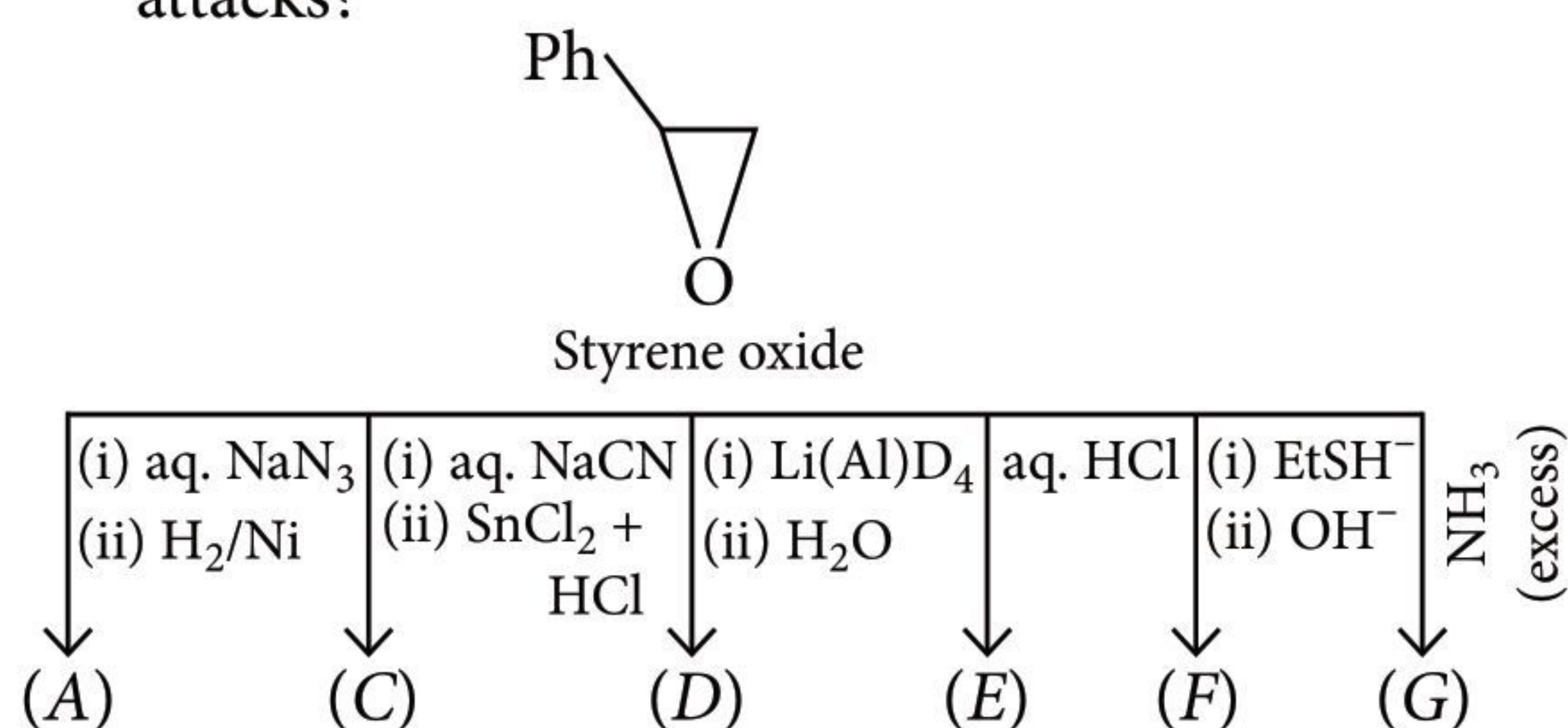
- (a) they ionise in water
 (b) they do not form H-bonds with water
 (c) they are highly viscous
 (d) they have very strong C-X bond.

25. A sample of chloroform before being used as an anaesthetic agent is tested by

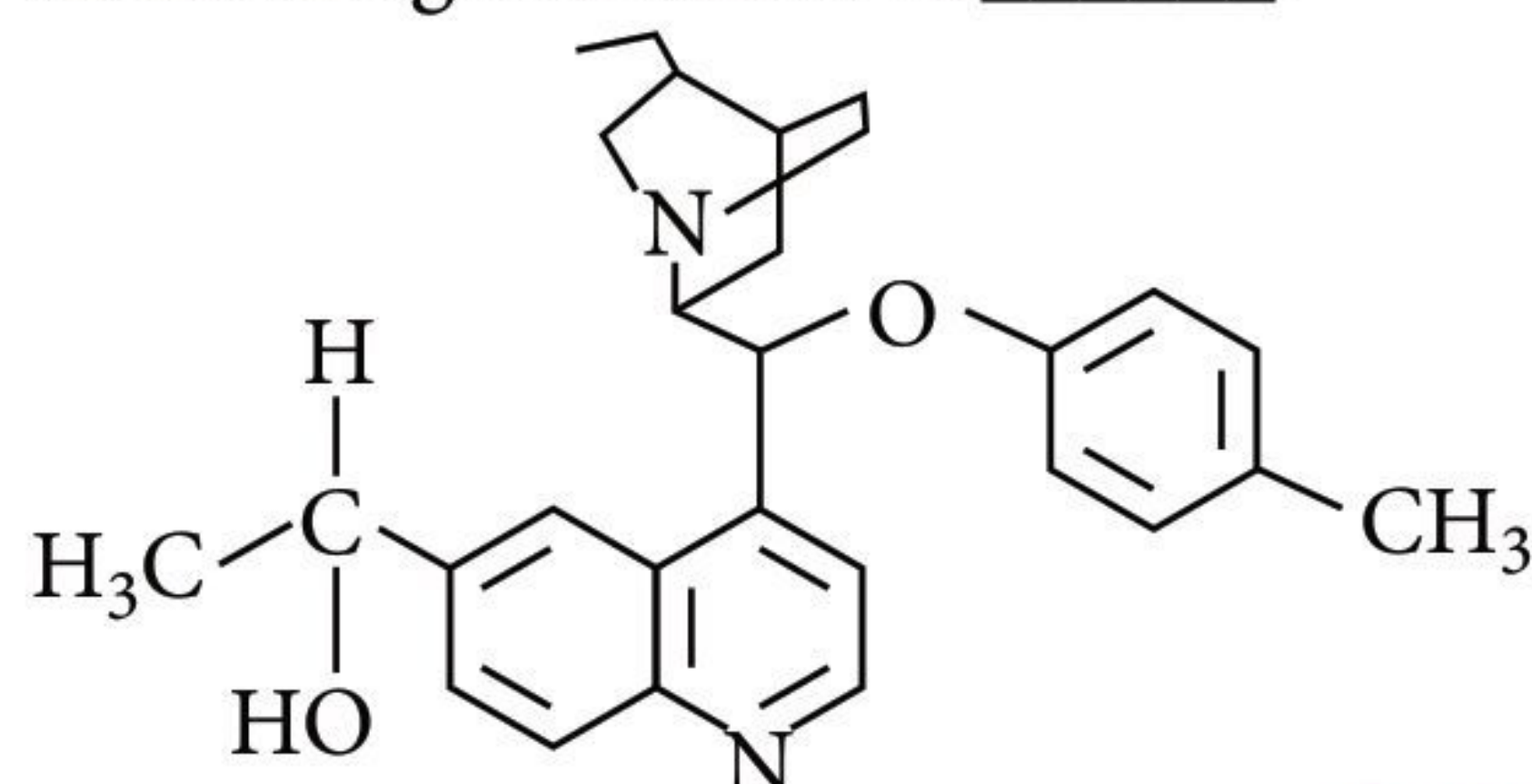
- (a) Fehling's solution
 (b) ammoniacal cuprous chloride
 (c) silver nitrate solution in the cold
 (d) silver nitrate solution after boiling with alcoholic KOH.

NUMERICAL VALUE TYPE

26. How many of the following reactions involve S_N2 attacks?



27. The number of pentyl alcohol producing blue colouration in the Victor-Meyer's test is _____.
 28. The number of chiral carbons present in the molecule given below is _____.



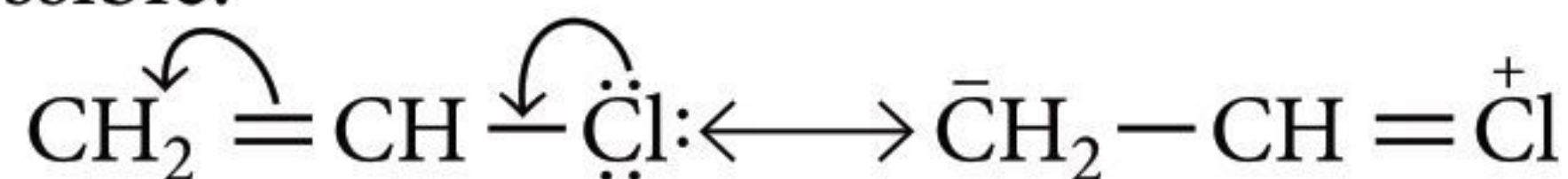
(JEE Main 2020)

29. *n*-Butane is produced by monobromination of ethane followed by the Wurtz reaction. If the bromination takes place with 90% yield and the Wurtz reaction with 85% yield, the volume of ethane (in L) at NTP required to produce 55 g *n*-butane is _____.
 30. Compound (X), (C₅H₈O) does not react appreciably with Lucas reagent at room temperature, but gives a precipitate with ammoniacal silver nitrate. With excess of MeMgBr, 0.42 g of (X) gives 224 mL CH₄ at STP. Treatment of (X) with H₂ in presence of Pt catalyst followed by boiling with excess HI gives *n*-pentane. The no. of acidic H-atoms in (X) are _____.

SOLUTIONS

1. (c)

2. (a): In vinyl chloride ($\text{CH}_2 = \text{CH} - \text{Cl}$), due to conjugation of lone pair with π -bond, resonance is possible.

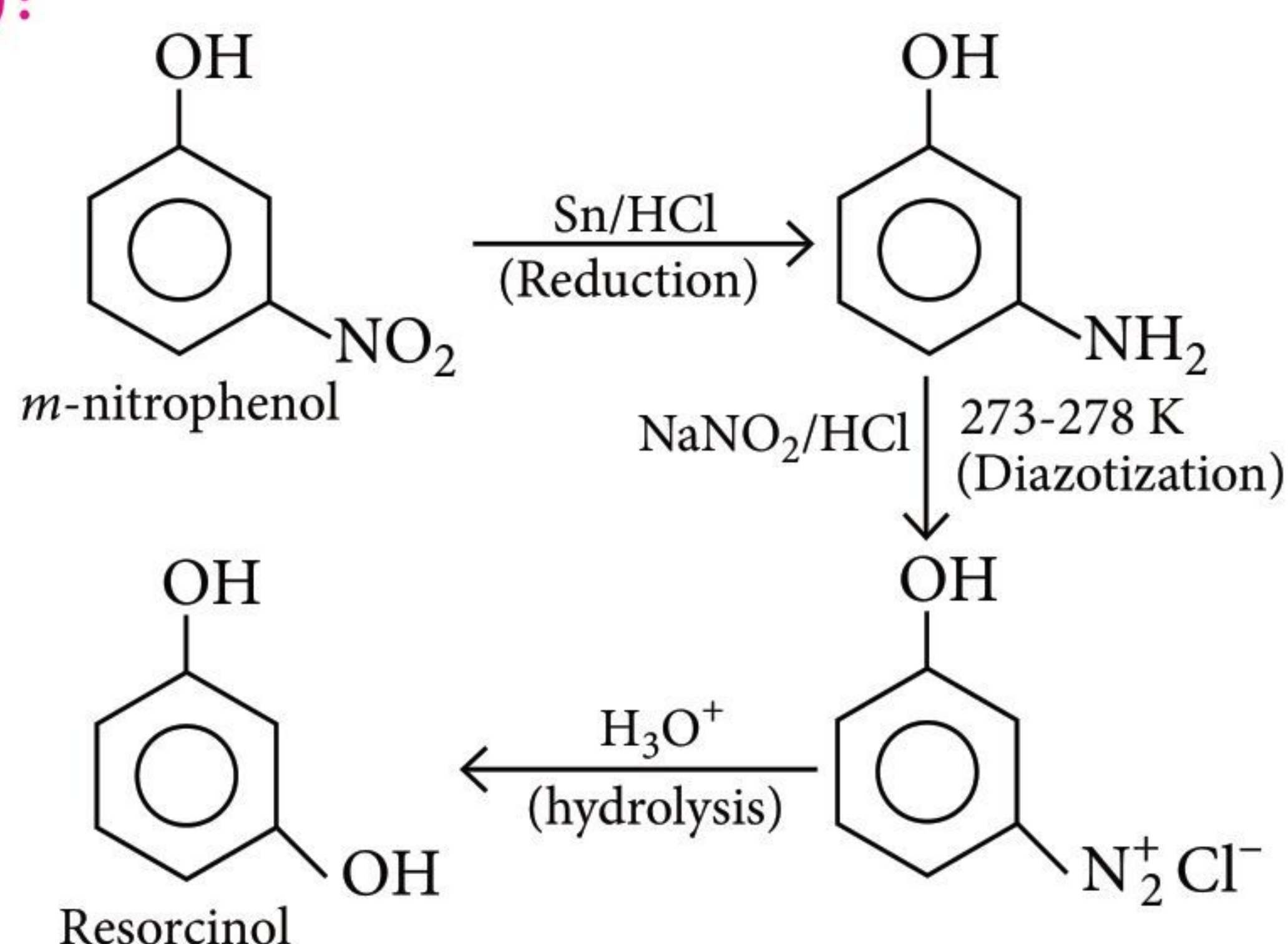


As due to resonance C—Cl bond have partial double bond character so, it has shortest bond length.

3. (b)

4. (b)

5. (d):



6. (c): $\text{S}_{\text{N}}2$ reaction proceed in polar aprotic solvents.

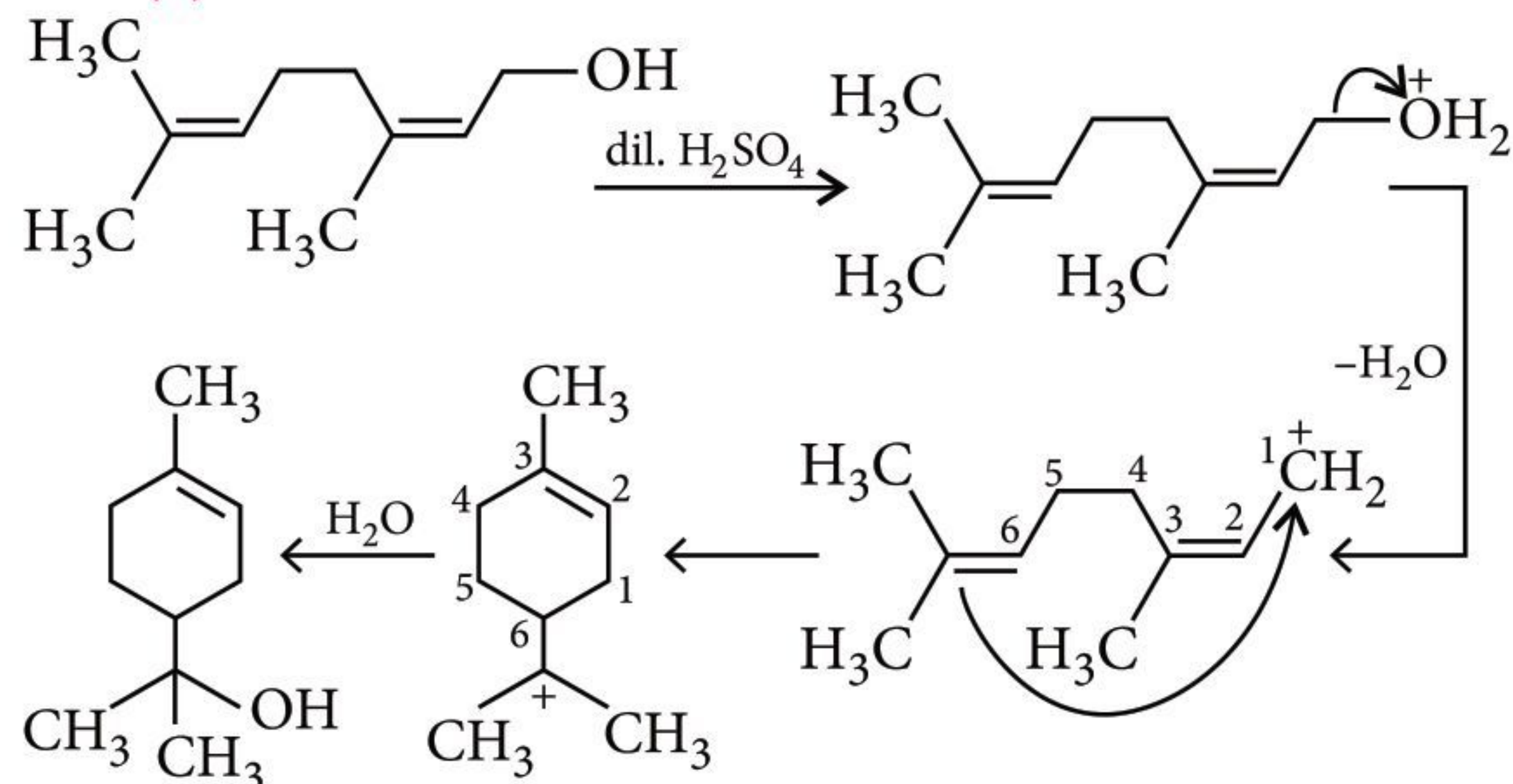
7. (a)

8. (d): The stability of carbocations follows the order :
 $(\text{C}_6\text{H}_5)_2\text{C}^+(\text{CH}_3) > (\text{C}_6\text{H}_5)_2\text{C}^+\text{H} > (\text{CH}_3)_3\text{C}^+ > (\text{CH}_3)_2\text{C}^+\text{H} > \text{CH}_3\text{C}^+\text{H}_2$

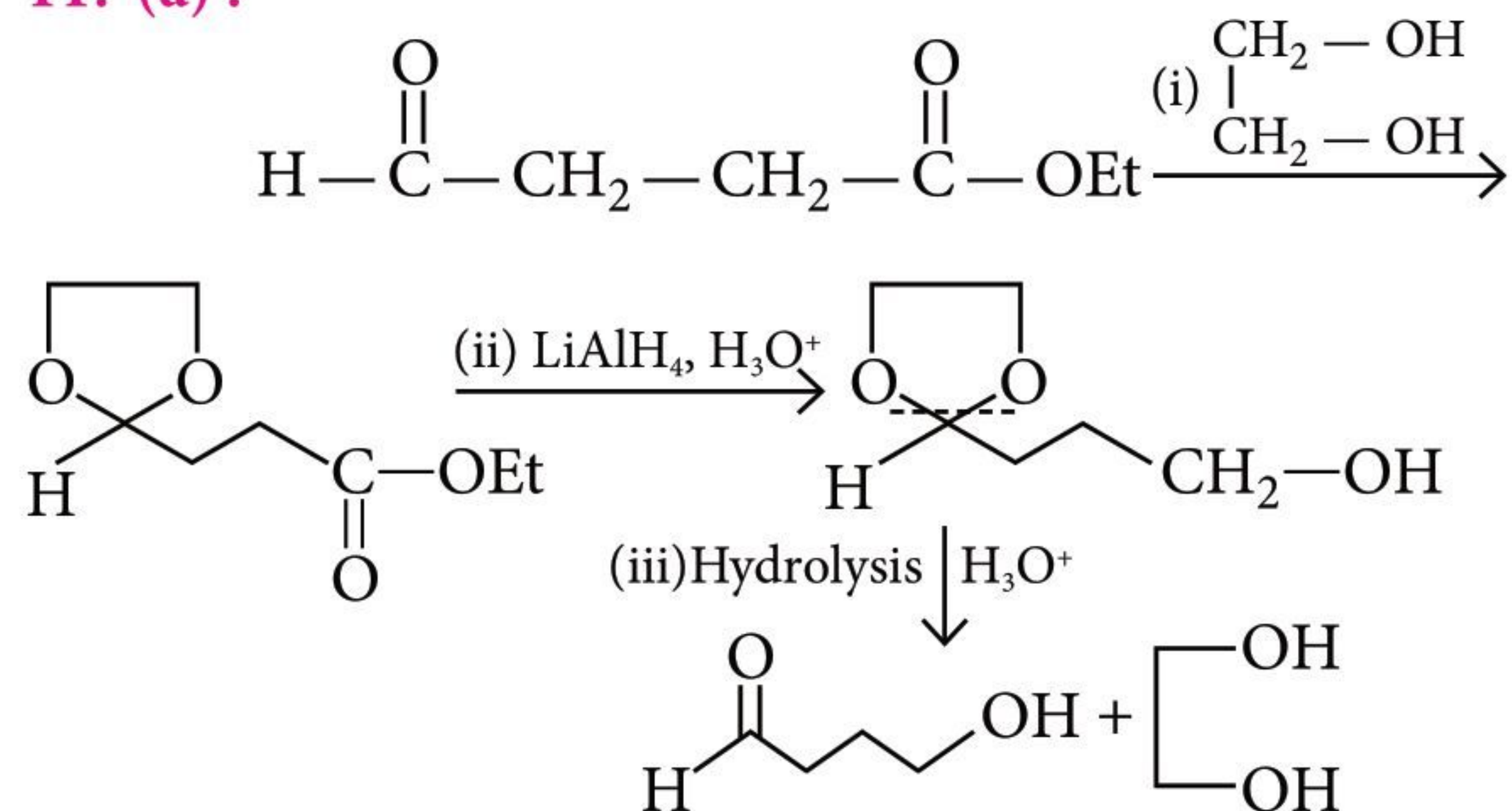
\therefore Order of reactivity towards $\text{S}_{\text{N}}1$ reaction is :
 $(\text{C}_6\text{H}_5)_2\text{C}(\text{CH}_3)\text{Br} > (\text{C}_6\text{H}_5)_2\text{CHBr} > (\text{CH}_3)_3\text{CBr} > (\text{CH}_3)_2\text{CHBr} > \text{C}_2\text{H}_5\text{Br}$
 (iii) (ii) (i) (iv) (v)

9. (b): When one of the alkyl groups is 3° and another is 1° , nature of reagent determines the type of mechanism ($\text{S}_{\text{N}}1$ or $\text{S}_{\text{N}}2$). A polar solvent or reagent capable of forming ions (*viz* conc. HI) will cause $\text{S}_{\text{N}}1$ reaction, while a non-polar solvent or a reagent not capable of forming ions (anhydrous HI) will cause $\text{S}_{\text{N}}2$ reaction.

10. (c):



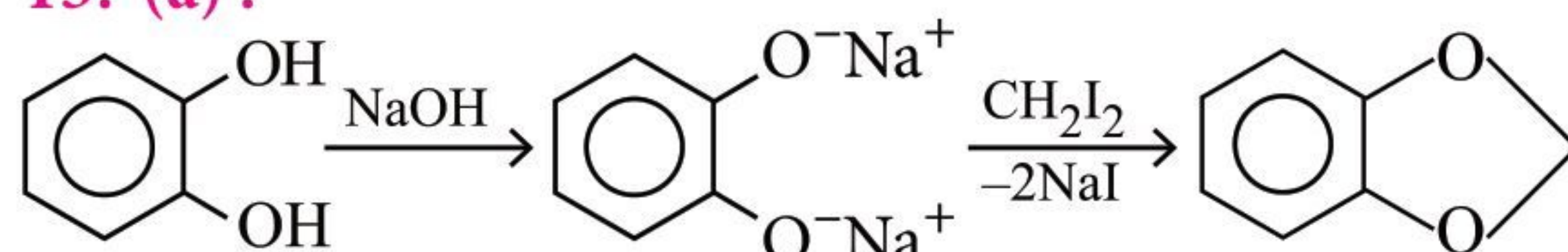
11. (a):



12. (b): $\text{R-OH} + \text{SOCl}_2 \xrightarrow[\text{Reflux}]{\text{Pyridine}} \text{R-Cl} + \text{SO}_2\uparrow + \text{HCl}\uparrow$

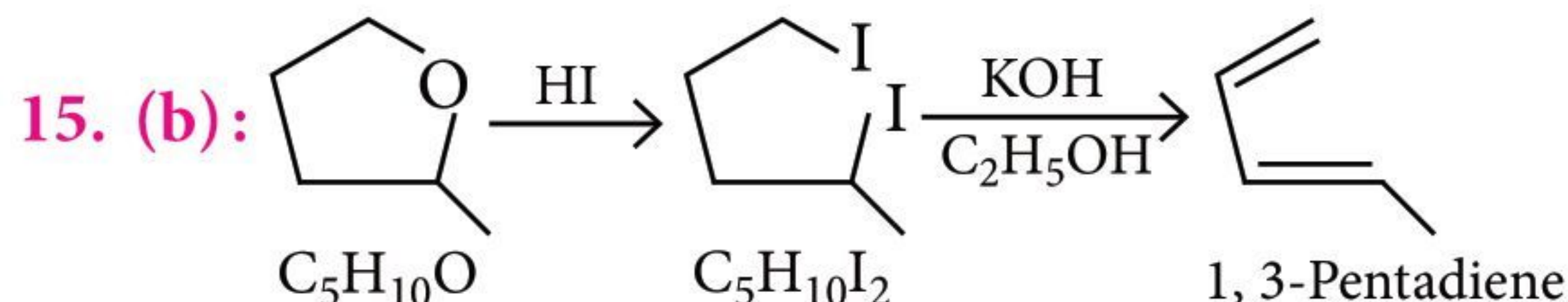
This is the best method for preparing alkyl chloride from alcohols. The advantage of this method is that the by products of the above reaction, *i.e.*, SO_2 and HCl are gases which can easily escape from the reaction mixture.

13. (a):

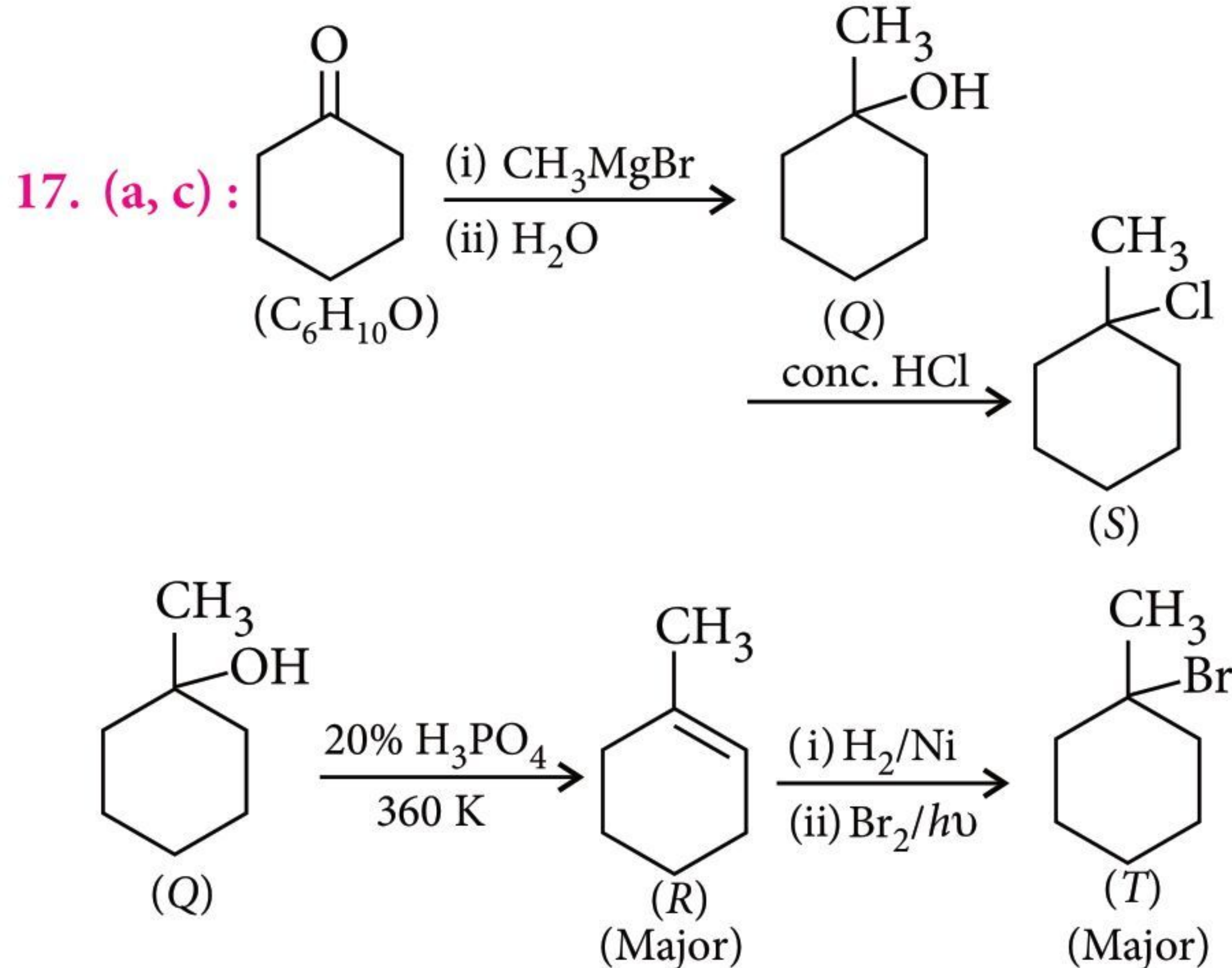
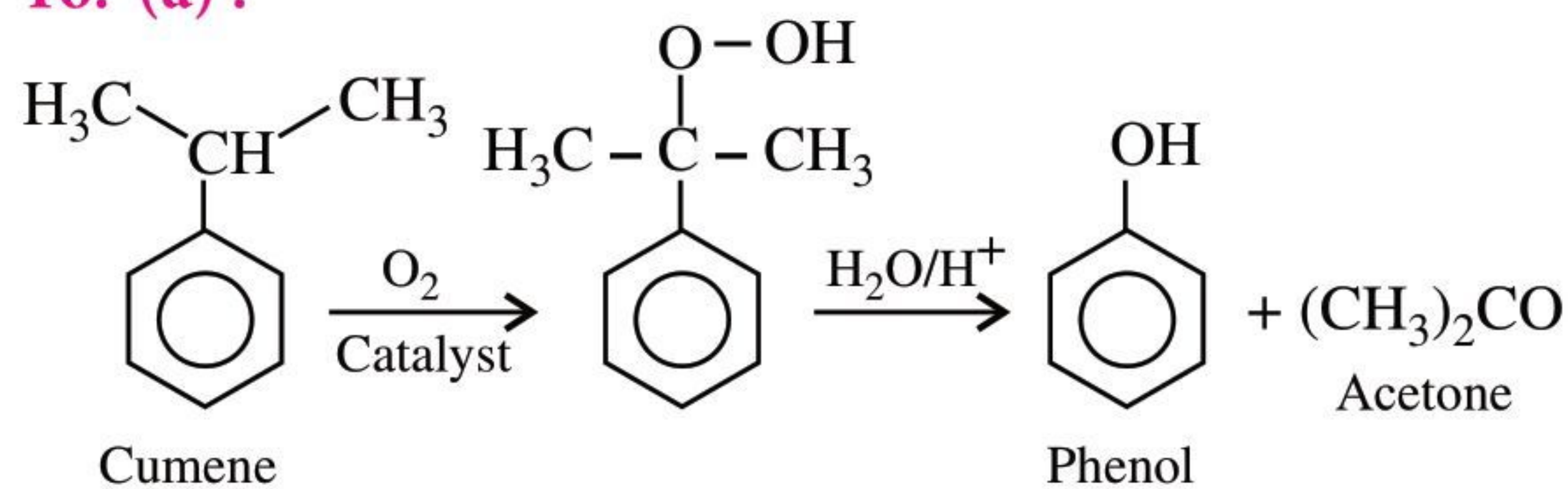


14. (d): $\text{C}_2\text{H}_5\text{Br} + \text{NaI} \xrightarrow[\text{Heat}]{\text{Acetone}} \text{C}_2\text{H}_5\text{I} + \text{NaBr}$
 Ethyl bromide Ethyl iodide

This reaction is called "Finkelstein reaction".



16. (a):





CBSE

warm-up!

Exam on
14th December
2021

CLASS-XII

TERM-I OBJECTIVE TYPE QUESTIONS

Practice Paper 2021

Time allowed : 90 minutes
Maximum marks : 35

GENERAL INSTRUCTIONS

1. The Question Paper contains three sections.
2. Section A has 25 questions. Attempt any 20 questions.
3. Section B has 24 questions. Attempt any 20 questions.
4. Section C has 6 questions. Attempt any 5 questions.
5. All questions carry equal marks.
6. There is no negative marking.

Mark your answer in the Sample OMR Sheet given after Practice Paper to get familiar with the actual paper pattern.

- The Solid State
- Solutions
- The *p*-Block Elements
- Haloalkanes and Haloarenes
- Alcohols, Phenols and Ethers
- Biomolecules

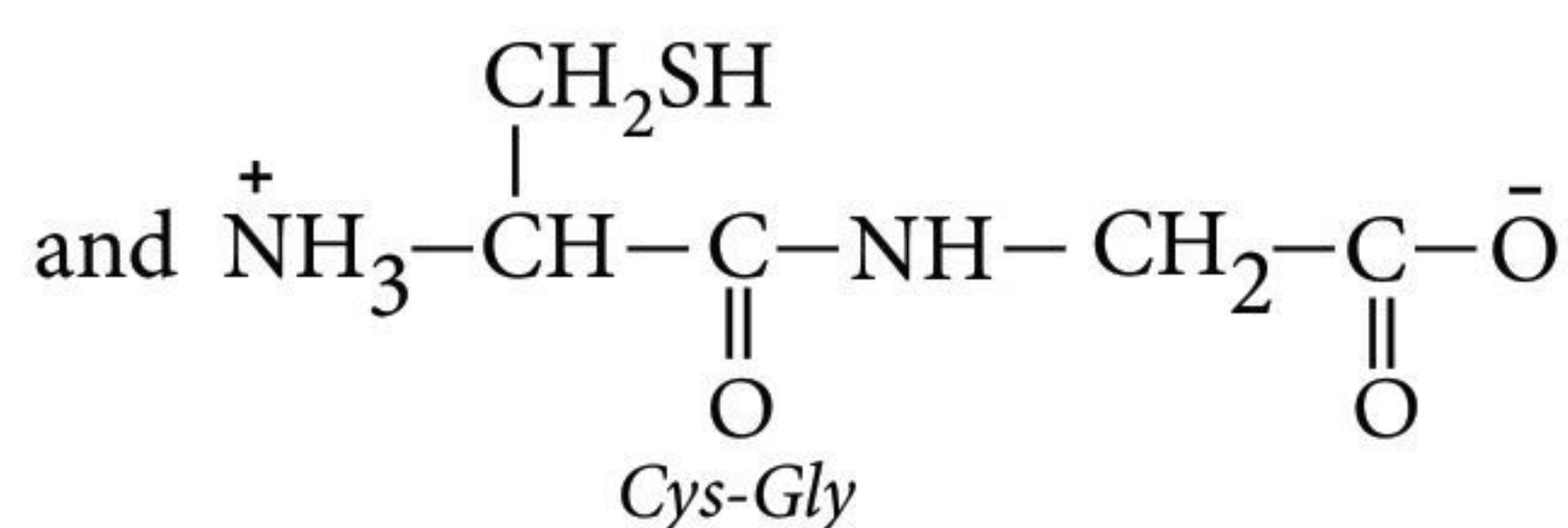
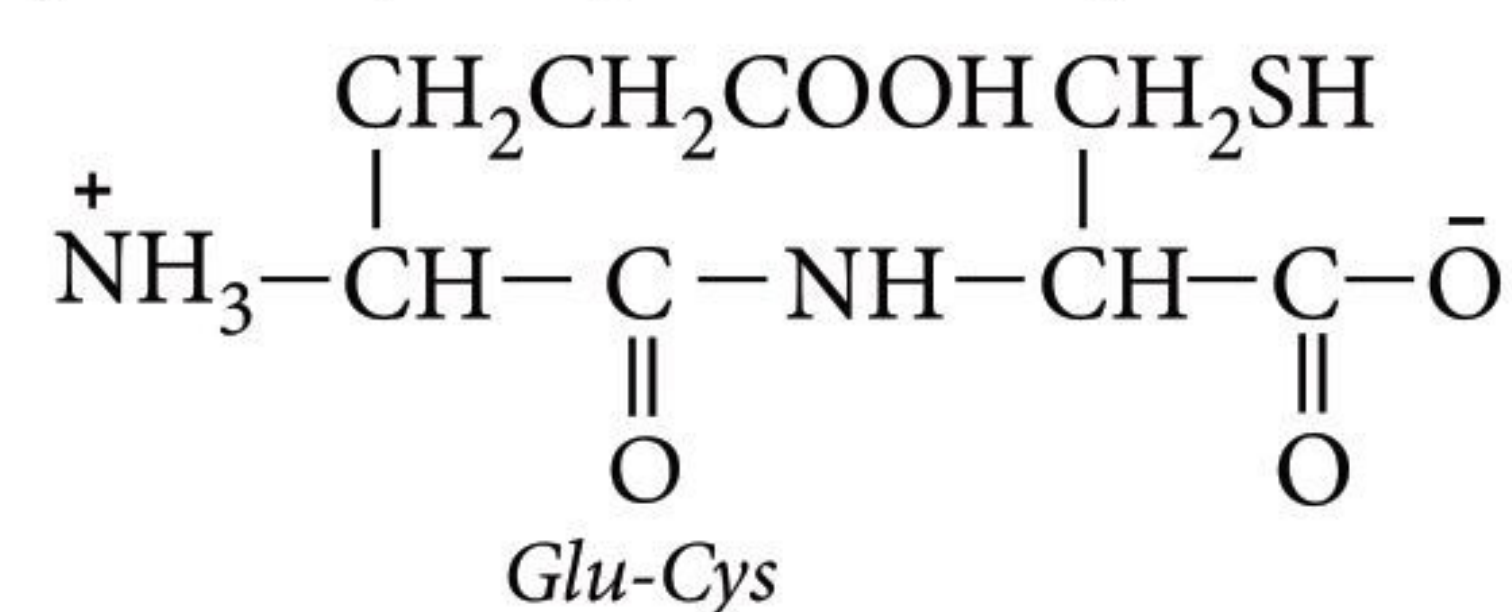
SECTION - A

This section consists of 25 multiple choice questions with overall choice to attempt any 20 questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.

1. Calculate the mass of a non-volatile solute (molar mass = 40 g mol^{-1}) which should be dissolved in 114 g octane to reduce its vapour pressure to 80%.
(a) 20 g (b) 10 g (c) 30 g (d) 45 g
2. 1.8 g of fructose ($\text{C}_6\text{H}_{12}\text{O}_6$) is added to 2 kg of water. The freezing point of solution is (K_f for water is 1.86)
(a) -0.0093°C (b) 0.0093°C
(c) -0.0186°C (d) -1.86°C
3. An alloy of copper, silver and gold is found to have cubic lattice in which Cu atoms constitute *ccp*. If Ag atoms are located at the edge centres and Au atom is present at body centre, the alloy will have the formula

- (a) CuAgAu (b) $\text{Cu}_4\text{Ag}_4\text{Au}$
(c) $\text{Cu}_4\text{Ag}_3\text{Au}$ (d) $\text{Cu}_4\text{Ag}_6\text{Au}$

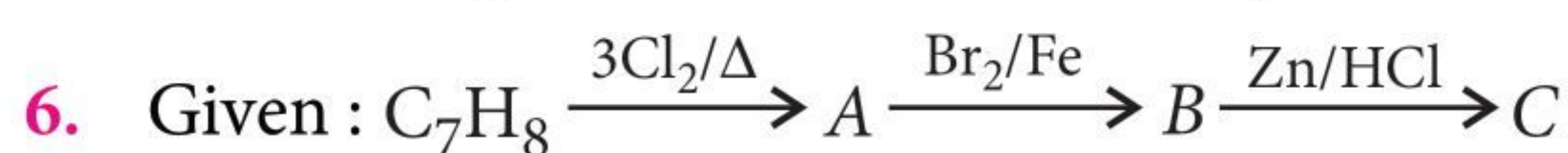
4. A tripeptide (X) on partial hydrolysis gave two dipeptides *Cys-Gly* and *Glu-Cys*, i.e.,



Identify the tripeptide.

- (a) *Glu-Cys-Gly* (b) *Gly-Glu-Cys*
(c) *Cys-Gly-Glu* (d) *Cys-Glu-Gly*
5. 200 mL of an aqueous solution of a protein contains its 1.26 g. The osmotic pressure of this solution at 300 K is found to be $2.57 \times 10^{-3} \text{ bar}$. The molar mass of protein will be
($R = 0.083 \text{ L bar mol}^{-1} \text{ K}^{-1}$)

- (a) 51022 g mol^{-1} (b) $122044 \text{ g mol}^{-1}$
 (c) 31011 g mol^{-1} (d) 61038 g mol^{-1}



The compound C is

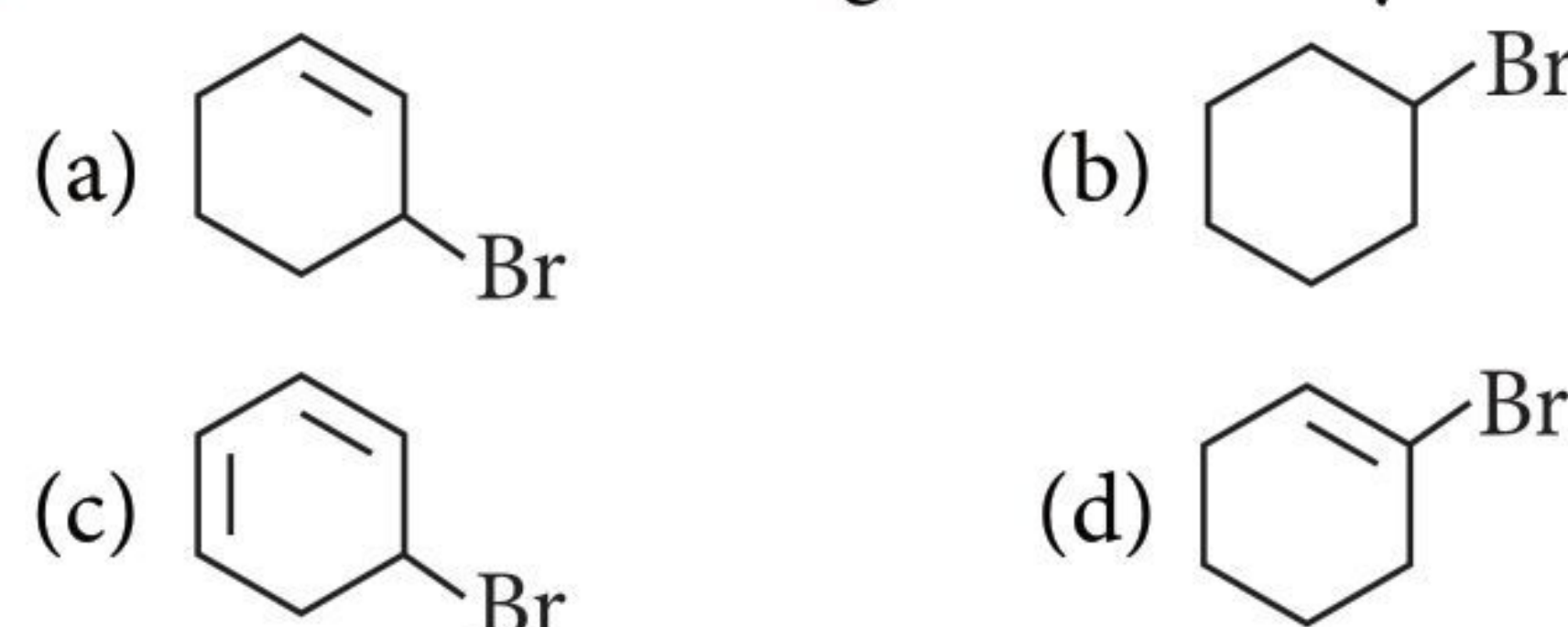
- (a) *o*-bromotoluene (b) *m*-bromotoluene
 (c) *p*-bromotoluene (d) 3-bromo-2,4,6-trichlorobenzene.
7. The acid in which O—O bonding is present is
 (a) $\text{H}_2\text{S}_2\text{O}_3$ (b) $\text{H}_2\text{S}_2\text{O}_6$
 (c) $\text{H}_2\text{S}_2\text{O}_8$ (d) $\text{H}_2\text{S}_4\text{O}_6$
8. Ferrous oxide has a cubic structure and each edge of the unit cell is 5.0 \AA . Assuming density of the oxide as 4.09 g cm^{-3} the number of Fe^{2+} and O^{2-} ions presents in each unit cell will be
 (a) two Fe^{2+} and four O^{2-}
 (b) three Fe^{2+} and three O^{2-}
 (c) four Fe^{2+} and two O^{2-}
 (d) four Fe^{2+} and four O^{2-}
9. The vapour pressure of a liquid decreases by 10 torr when a non-volatile solute is dissolved. The mole fraction of the solute in solution is 0.1. What would be the mole fraction of the liquid if the decrease in vapour pressure is 20 torr when the solute being dissolved is same?
 (a) 0.2 (b) 0.9 (c) 0.8 (d) 0.6

10. Which of the following pairs is/are correctly matched?

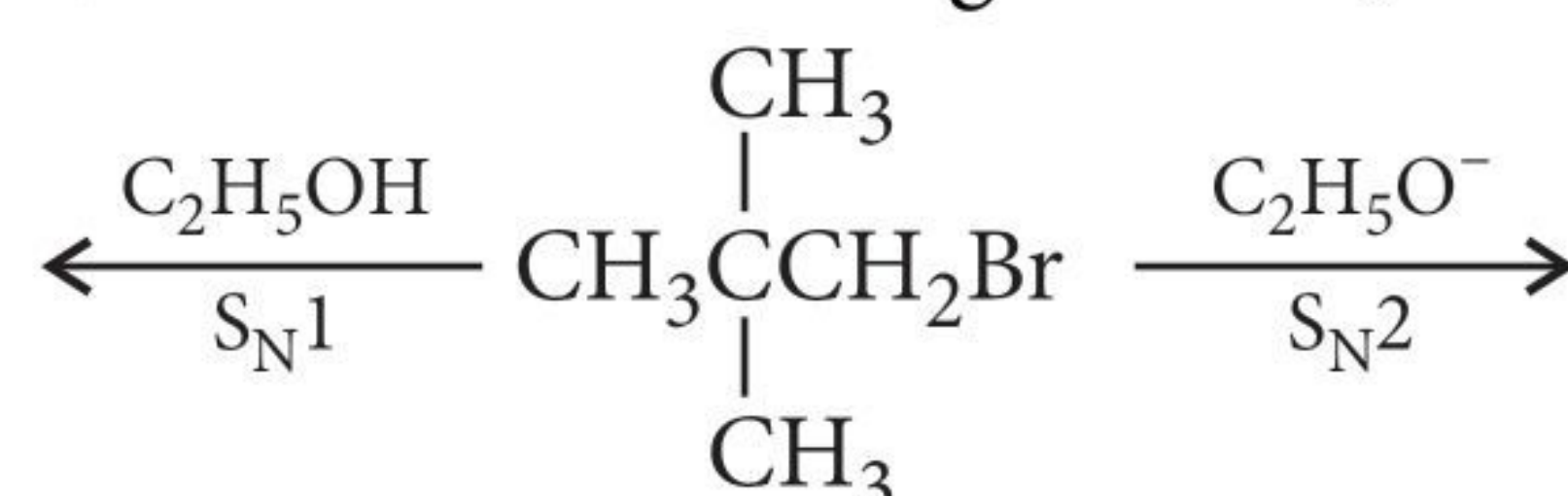
Reaction	Product
I. $\text{RX} + \text{AgCN}$	RNC
II. $\text{RX} + \text{KCN}$	RCN
III. $\text{RX} + \text{KNO}_2$	$\text{R}-\text{N} \begin{array}{c} \nearrow \text{O} \\ \searrow \text{O} \end{array}$
IV. $\text{RX} + \text{AgNO}_2$	$\text{R}-\text{O}-\text{N}=\text{O}$
(a) Only I	(b) I and II
(c) III and IV	(d) I, II, III and IV

11. After adding non-volatile solute freezing point of water decreases to -0.186°C . Calculate ΔT_b if $K_f = 1.86 \text{ K kg mol}^{-1}$ and $K_b = 0.521 \text{ K kg mol}^{-1}$.
 (a) 0.0521 K (b) 0.0186 K
 (c) 0.521 K (d) 1.86 K
12. The flame colours of metal ions are due to
 (a) Schottky defect
 (b) Frenkel defect
 (c) metal excess defect
 (d) metal deficiency defect.

13. Which of the following will be readily de-brominated?

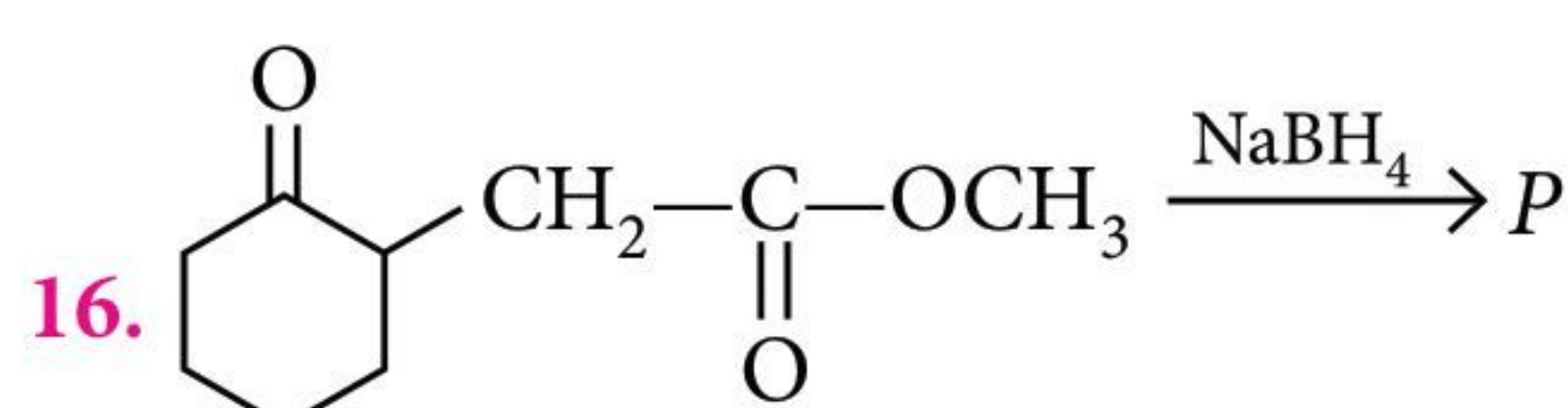


14. Consider the following reaction,

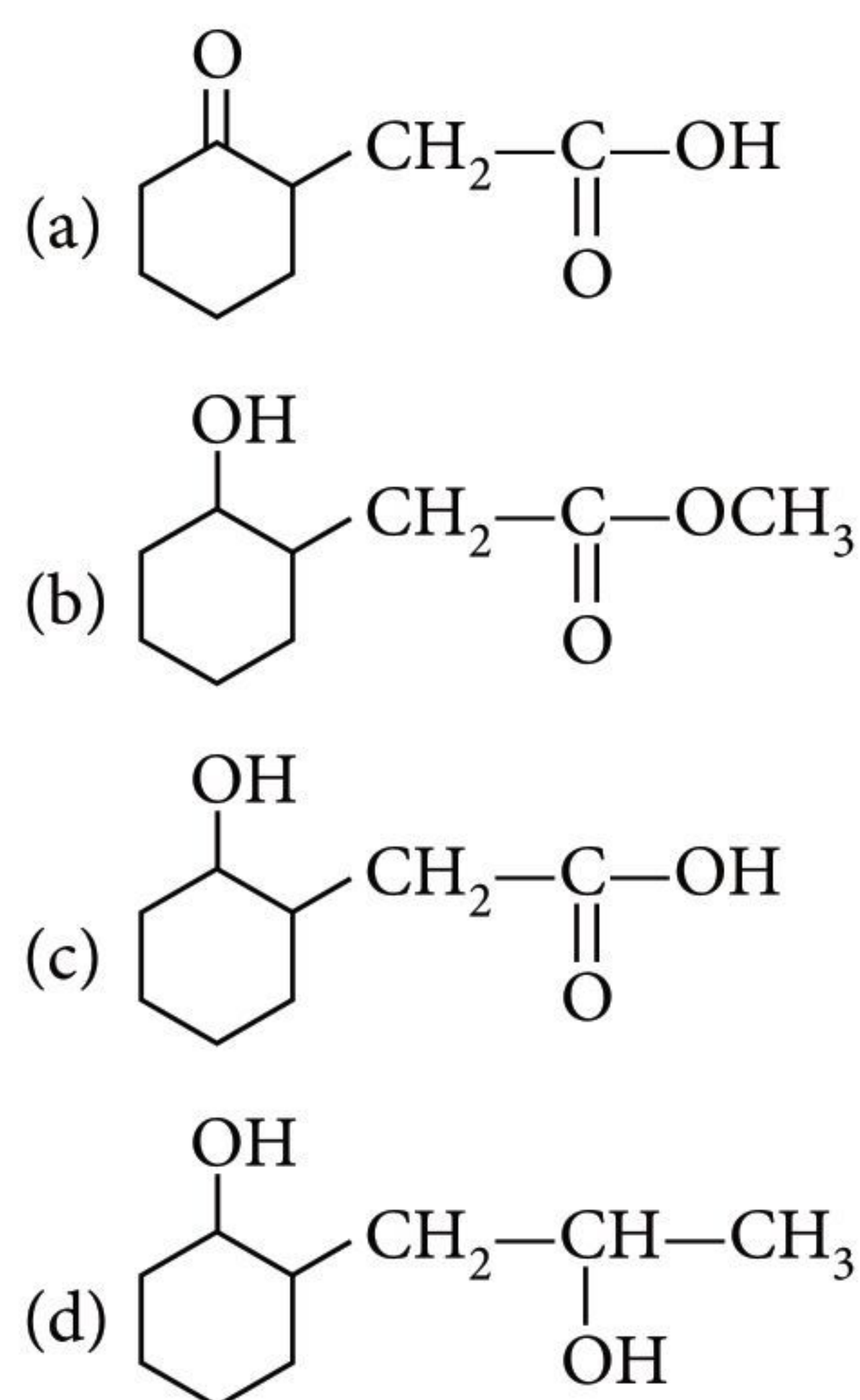


$(\text{CH}_3)_3\text{CCH}_2\text{Br}$ shows $\text{S}_{\text{N}}2$ reaction with $\text{C}_2\text{H}_5\text{O}^-$ and $\text{S}_{\text{N}}1$ reaction with $\text{C}_2\text{H}_5\text{OH}$ as given above. Select the incorrect statement.

- (a) Product obtained by $\text{S}_{\text{N}}2$ reaction has inverted configuration.
 (b) Product obtained due to $\text{S}_{\text{N}}1$ reaction is a tertiary ether.
 (c) Product obtained due to $\text{S}_{\text{N}}2$ reaction is a primary ether.
 (d) None of these.
15. Which of the following compounds would not react with Lucas reagent at room temperature?
 (a) $\text{H}_2\text{C}=\text{CHCH}_2\text{OH}$ (b) $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$
 (c) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ (d) $(\text{CH}_3)_3\text{COH}$



The compound P should be



CBSE CHAMPION Chapterwise -Topicwise Solved Papers



CBSE CHAMPION Chapterwise-Topicwise Solved Papers Series contains topicwise questions and solutions asked over last decade in CBSE-Board examination.

Questions are supported with topicwise graphical analysis of previous years CBSE Board questions as well as comprehensive and lucid theory. The questions in each topic have been arranged in descending order as per the marks category. Questions from Delhi, All India, Foreign and Compartment papers are included. This ensures that all types of questions that are necessary for Board exam preparation have been covered.

Important feature of these books is that the solutions to all the questions have been given according to CBSE marking scheme. CBSE sample paper and practice papers are also supplemented.

Examination papers for Class- 10 and 12 Boards are based on a certain pattern. To excel, studying right is therefore more important than studying hard, which is why we created this series.



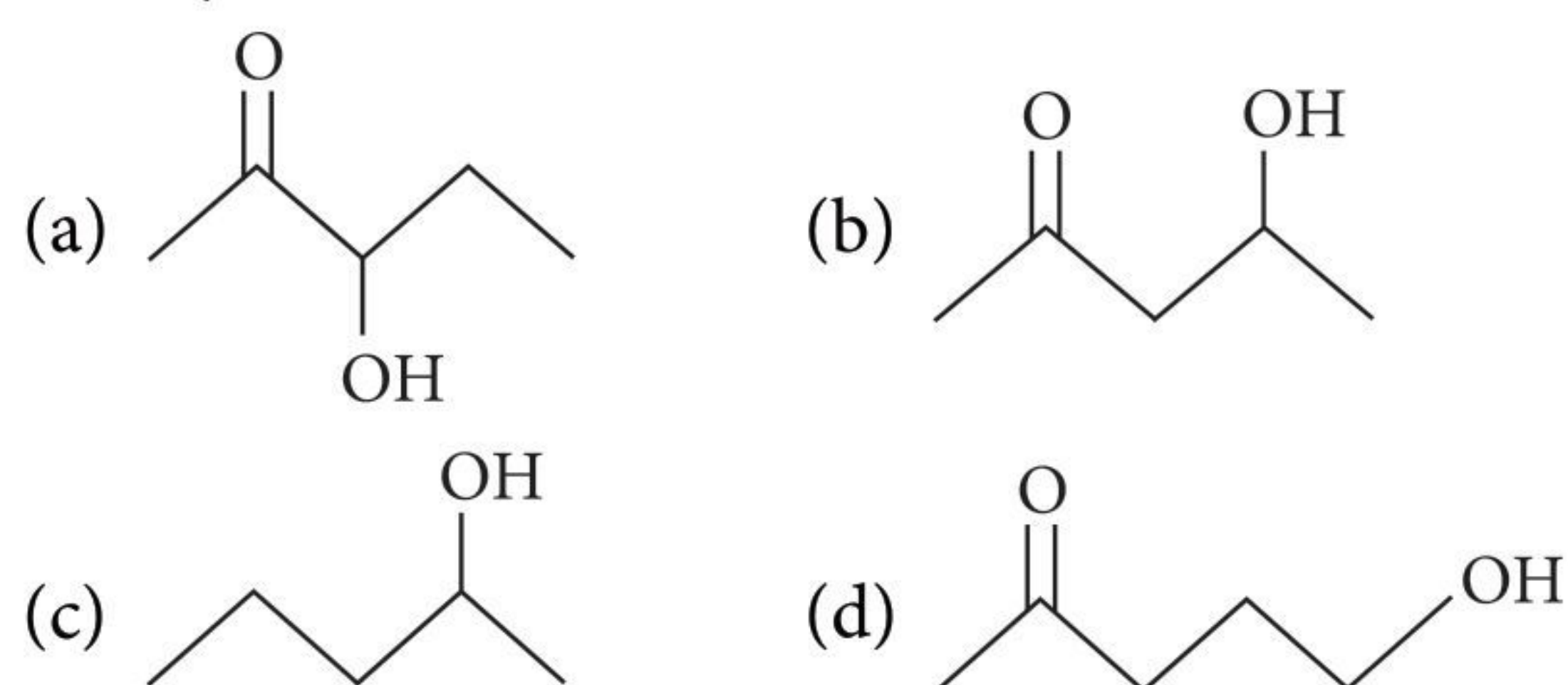
Available at all leading book shops throughout India.
For more information or for help in placing your order:
Call 0124-6601200 or email info@mtg.in

Visit
www.mtg.in
for latest offers
and to buy
online!

17. Which of the following reactions could not be explained on the basis of open chain structure of glucose?

- (a) Pentaacetate of glucose does not react with NH_2OH .
- (b) Glucose on prolonged heating with HI gives *n*-hexane.
- (c) Glucose on oxidation with bromine water forms gluconic acid.
- (d) With acetic anhydride glucose gives pentaacetate.

18. Which of the following will be dehydrated most readily in alkaline medium?



19. Among the following statements, which one is incorrect?

- (a) Nitrogen has the ability to form $p\pi-p\pi$ bonds with itself.
- (b) Bismuth forms metallic bonds in elemental state.
- (c) Catenation tendency is higher in nitrogen when compared with other elements of the same group.
- (d) Nitrogen has higher first ionization enthalpy when compared with other elements of the same group.

20. A mixture of ethyl alcohol and propyl alcohol has a vapour pressure of 290 mm at 300 K. The vapour pressure of propyl alcohol is 200 mm. If the mole fraction of ethyl alcohol is 0.6, its vapour pressure (in mm) at the same temperature will be

- (a) 360 (b) 350 (c) 300 (d) 700

21. Within the list shown below, the correct pair of structures of alanine in pH ranges 2-4 and 9-11 respectively is

- I. $\text{H}_3\text{N}^+-\text{CH}(\text{CH}_3)\text{CO}_2\text{H}$
- II. $\text{H}_2\text{N}-\text{CH}(\text{CH}_3)\text{CO}_2^-$
- III. $\text{H}_3\text{N}^+-\text{CH}(\text{CH}_3)\text{CO}_2^-$
- IV. $\text{H}_2\text{N}-\text{CH}(\text{CH}_3)\text{CO}_2\text{H}$

- (a) I, II (b) I, III
- (c) II, III (d) III, IV

22. The correct statement regarding, (i) HClO , (ii) HClO_2 , (iii) HClO_3 and (iv) HClO_4 , is/are

- (a) the number of $\text{Cl}=\text{O}$ bonds in (ii) and (iii) together is two
- (b) the number of lone pairs of electrons on Cl in (ii) and (iii) together is three
- (c) the hybridization of Cl in (iv) is sp^2
- (d) amongst (i) to (iv), the strongest acid is (i).

23. Products (P_2) $\xleftarrow{\text{anhy. HI}}$ $(\text{CH}_3)_3\text{C}-\text{O}-\text{CH}_3$
 $\xrightarrow{\text{conc. HI}}$ Products(P_1)

The products P_1 and P_2 respectively are

- (a) $(\text{CH}_3)_3\text{COH} + \text{CH}_3\text{I}$ and $(\text{CH}_3)_3\text{Cl} + \text{CH}_3\text{OH}$
- (b) $(\text{CH}_3)_3\text{Cl} + \text{CH}_3\text{OH}$ and $(\text{CH}_3)_3\text{COH} + \text{CH}_3\text{I}$
- (c) $(\text{CH}_3)_3\text{Cl} + \text{CH}_3\text{OH}$ in both cases
- (d) CH_3I and $(\text{CH}_3)_3\text{COH}$ in both cases.

24. The presence or absence of hydroxy group on which carbon atom of sugar differentiates RNA and DNA.

- (a) 1st (b) 2nd
- (c) 3rd (d) 4th

25. A dark brown solid (X) reacts with NH_3 to form a mild explosive which decomposes to give a violet coloured gas. (X) also reacts with H_2 to give an acid (Y). (Y) can also be prepared by heating its salt with H_3PO_4 . X and Y are respectively

- (a) Cl_2 , HCl (b) SO_2 , H_2SO_4
- (c) Br_2 , HBr (d) I_2 , HI

SECTION - B

This section consists of 24 multiple choice questions with overall choice to attempt any 20 questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.

26. A mineral MX_2 crystallizes in *ccp* of M^{2+} ions whereas X^- ions occupy the tetrahedral voids. The number of cations and anions per unit cell, the coordination number of cation and percent of tetrahedral voids occupied are

- (a) 4, 8, 8, 100% (b) 4, 8, 8, 50%
- (c) 8, 4, 8, 50% (d) 8, 4, 8, 100%

27. For the determination of molecular weights, Raoult's law is applicable only to

- (a) dilute solutions of electrolytes
- (b) concentrated solutions of electrolytes
- (c) dilute solutions of non-electrolytes
- (d) concentrated solutions of non-electrolytes.

28. The stability of interhalogen compounds follows the order :

- (a) $\text{IF}_3 > \text{BrF}_3 > \text{ClF}_3$ (b) $\text{BrF}_3 > \text{IF}_3 > \text{ClF}_3$
 (c) $\text{ClF}_3 > \text{BrF}_3 > \text{IF}_3$ (d) $\text{ClF}_3 > \text{IF}_3 > \text{BrF}_3$

29. The reaction of $\text{CH}_3\text{CH}=\text{CH}-\text{C}_6\text{H}_4-\text{OH}$ with HBr gives

- (a) $\text{CH}_3\text{CHBrCH}_2-\text{C}_6\text{H}_4-\text{OH}$
 (b) $\text{CH}_3\text{CH}_2\text{CHBr}-\text{C}_6\text{H}_4-\text{OH}$
 (c) $\text{CH}_3\text{CHBrCH}_2-\text{C}_6\text{H}_3(\text{Br})-\text{OH}$
 (d) $\text{CH}_3\text{CH}_2\text{CHBr}-\text{C}_6\text{H}_3(\text{Br})-\text{OH}$

30. The sequence of bases on RNA molecule synthesized on the GCATA strand of DNA is

- (a) CGUAU (b) CGTAT
 (c) TACGC (d) AYC GC

31. The radius of an atom is 300 pm. If it crystallizes in a face-centered cubic lattice, the length of the edge of the unit cell is

- (a) 488.5 pm (b) 848.5 pm
 (c) 884.5 pm (d) 484.5 pm

32. The α - and β - forms of glucose are

- (a) isomers of $D(+)$ -glucose and $L(-)$ -glucose respectively
 (b) diastereomers of glucose
 (c) anomers of glucose
 (d) isomers which differ in the configuration of C-2.

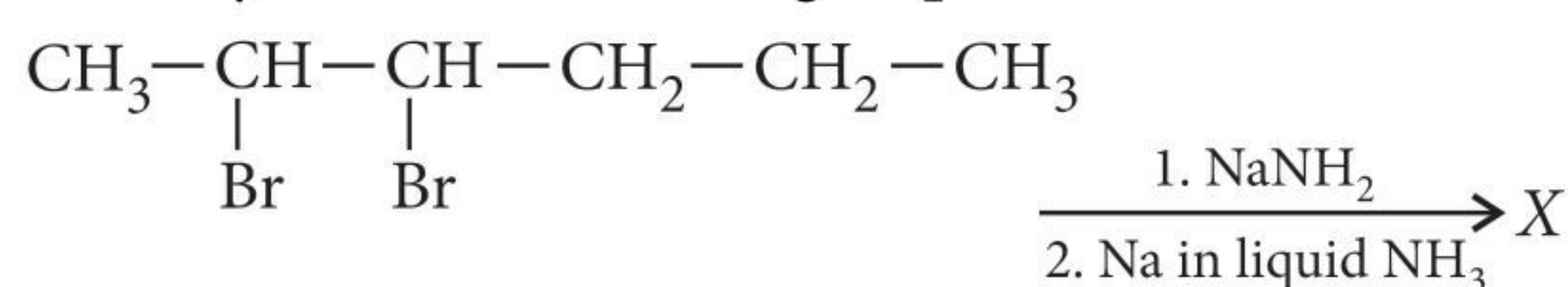
33. A flask is partially evacuated to 400 torr pressure of air. A small amount of benzene is introduced into the flask in order that some liquid will remain after equilibrium has been established. The vapour pressure of benzene at 25°C is 220 torr. What is the total pressure in the flask at equilibrium at 25°C ?

- (a) 120 torr (b) 510 torr
 (c) 620 torr (d) 480 torr

34. On mixing, heptane and octane form an ideal solution. At 373 K, the vapour pressure of the two liquid components (heptane and octane) are 105 kPa and 45 kPa respectively. Vapour pressure of the solution obtained by mixing 25 g of heptane and 35 g of octane will be (molar mass of heptane = 100 g mol^{-1} and of octane = 114 g mol^{-1})

- (a) 144.5 kPa (b) 72.0 kPa
 (c) 36.1 kPa (d) 96.2 kPa

35. Identify X in the following sequence of reactions :



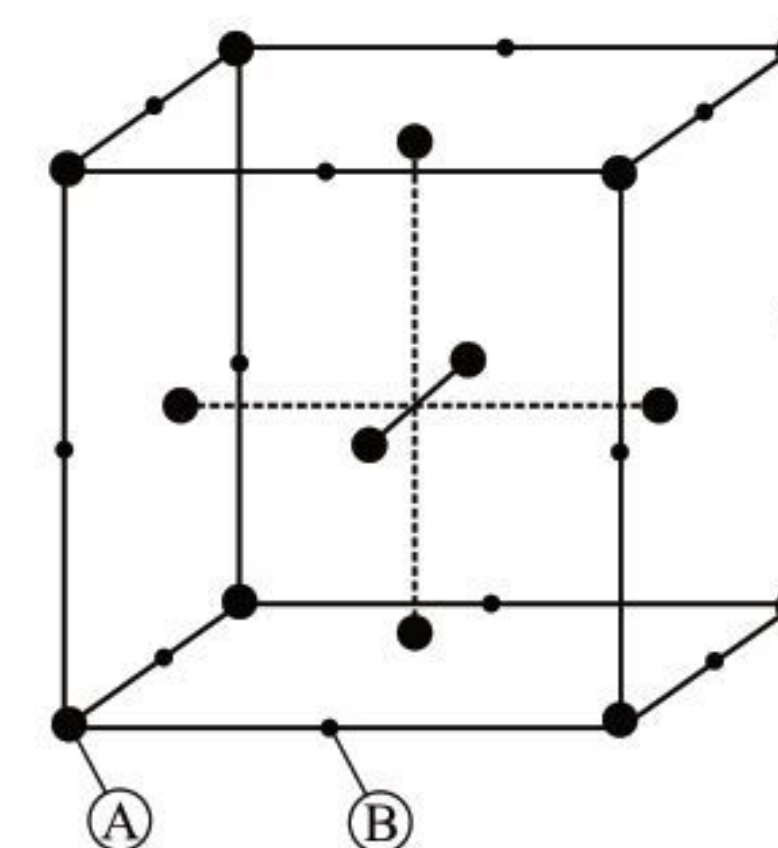
- (a) $\text{CH}_3-\underset{\text{Br}}{\text{CH}}-\underset{\text{NH}_2}{\text{CH}}-\text{CH}_2\text{CH}_2\text{CH}_3$
 (b) $\text{CH}_3-\text{C}(\text{H})=\text{C}(\text{H})-\text{CH}_2\text{CH}_2\text{CH}_3$
 (c) $\text{CH}_3-\text{C}(\text{H})=\text{C}(\text{H})-\text{CH}_2\text{CH}_2\text{CH}_3$
 (d) $\text{CH}_3-\underset{\text{NH}_2}{\text{CH}}-\underset{\text{NH}_2}{\text{CH}}-\text{CH}_2\text{CH}_2\text{CH}_3$

36. Which one of the following statements is correct?

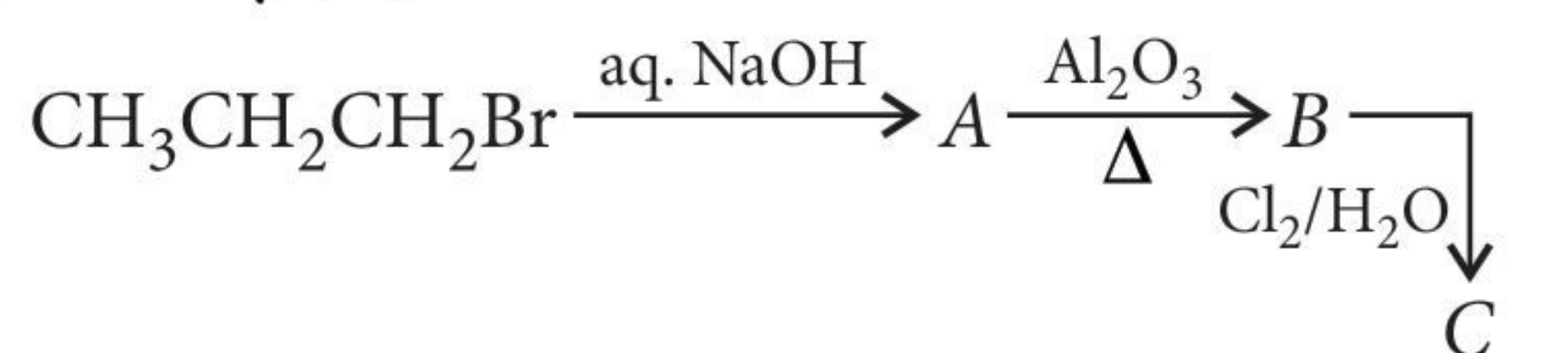
- (a) All amino acids are optically active.
 (b) All amino acids except glycine are optically active.
 (c) All amino acids except glutamic acid are optically active.
 (d) All amino acids except lysine are optically active.

37. For a solid with the following structure, coordination number of the point B is

- (a) 3
 (b) 4
 (c) 5 (d) 6



38. Identify (C) in

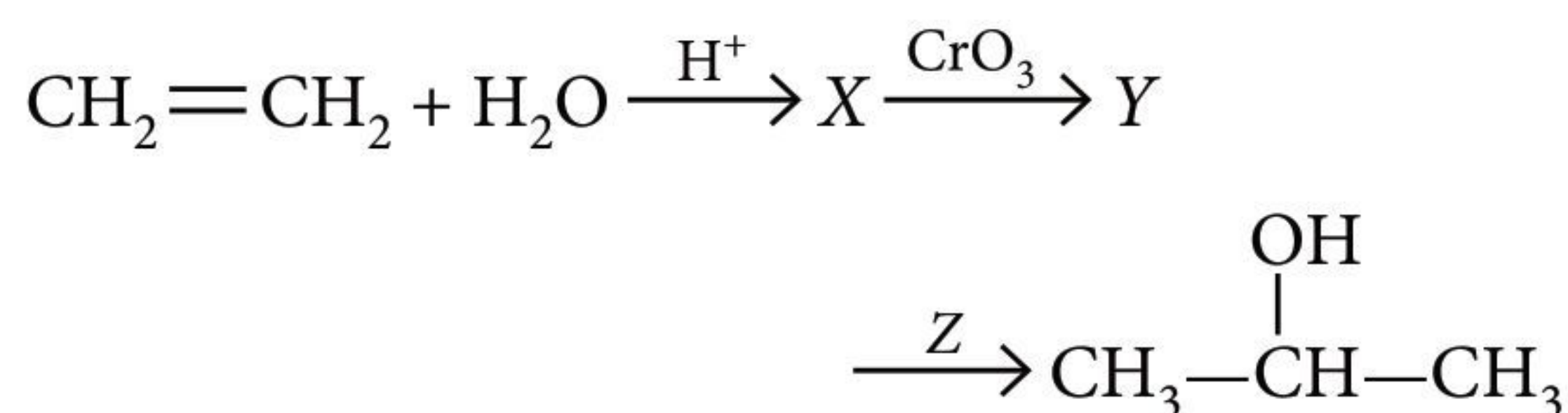


- (a) $\text{CH}_3\text{CHOHCH}_2\text{Cl}$ (b) $\text{CH}_3\text{CHClCH}_2\text{Cl}$
 (c) mixture of $\text{CH}_3\text{CHClCH}_2\text{Cl}$ and $\text{CH}_3\text{CHOHCH}_2\text{Cl}$
 (d) $\text{CH}_3\text{CHClCH}_2\text{OH}$

39. Among the following molecules :

- (i) XeO_3 (ii) XeOF_4 (iii) XeF_6
 those having same number of lone pairs on Xe are
 (a) (i) and (ii) only (b) (i) and (iii) only
 (c) (ii) and (iii) only (d) all of these.

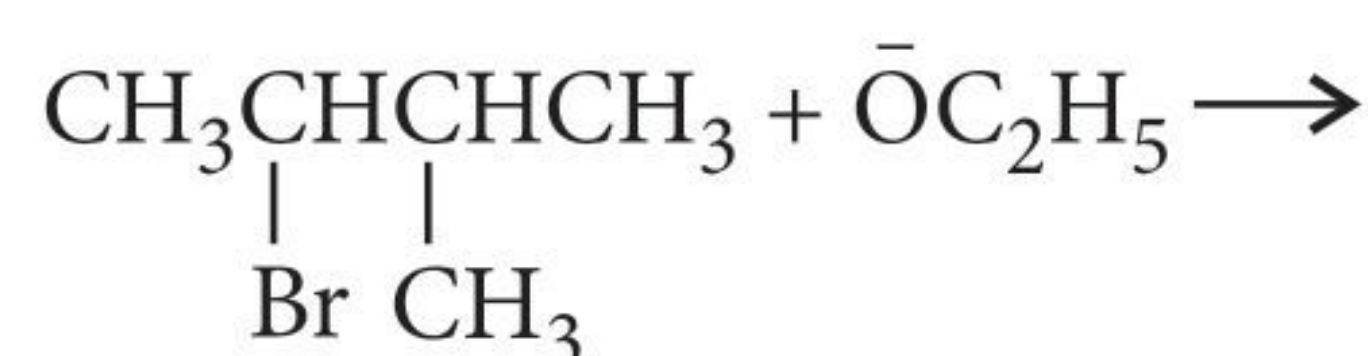
40. In the given reaction,



Z is

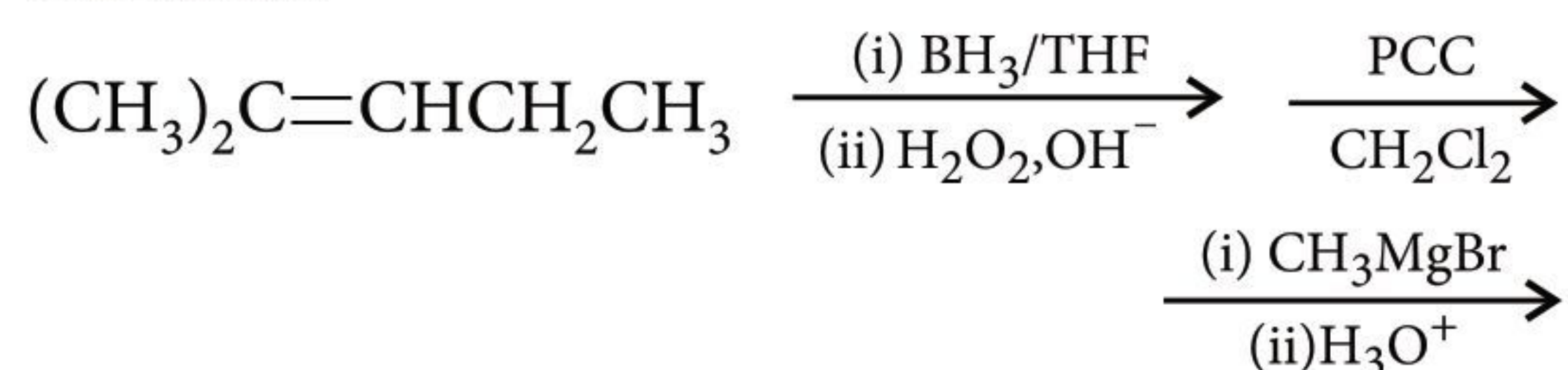
- (a) H_2/Pd (b) aq. KOH/Δ
(c) $\text{CH}_3\text{MgBr}/\text{H}_2\text{O}$ (d) NaOH/HCl

41. Major product of the following $\text{S}_{\text{N}}1$ reaction is



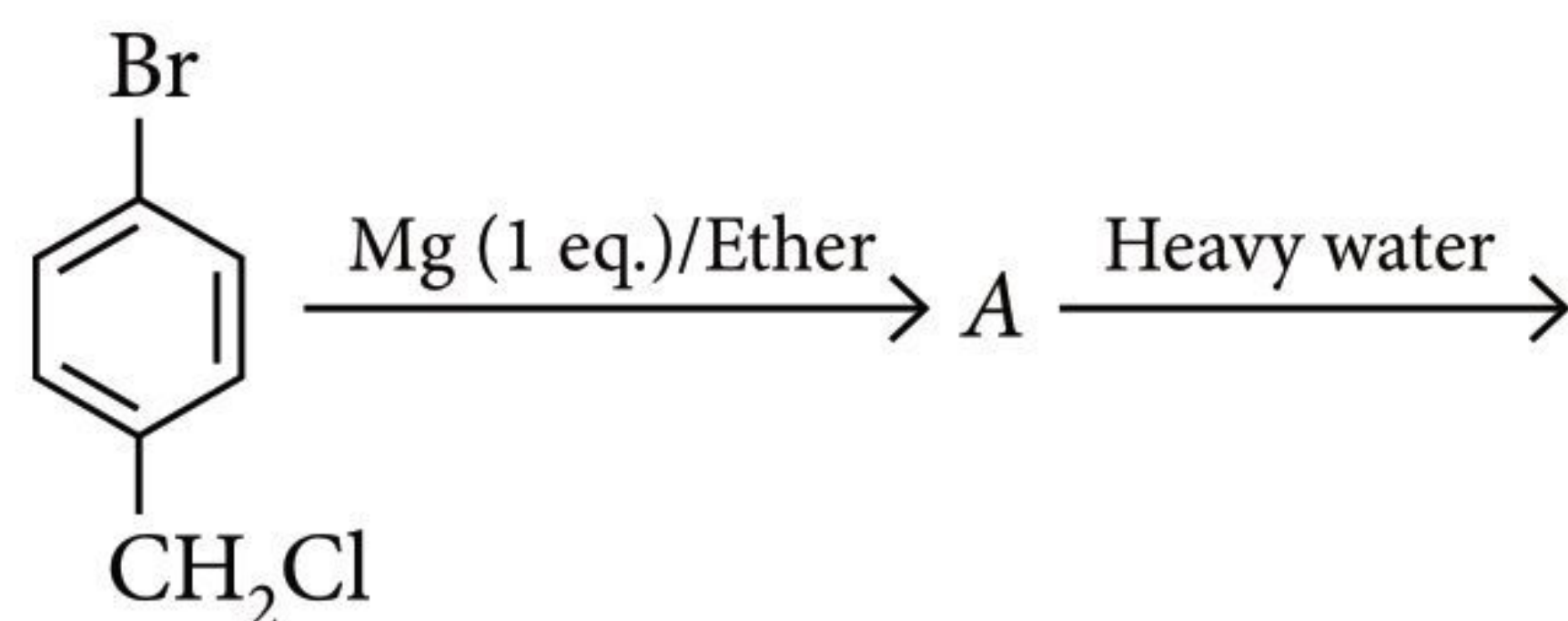
- (a) $\text{CH}_3\underset{\text{OC}_2\text{H}_5}{\text{CH}}\underset{\text{CH}_3}{\text{CH}}\text{CH}_3$ (b) $\text{CH}_3\underset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{CH}_2\text{OC}_2\text{H}_5$
(c) $\text{CH}_3\text{CH}_2\underset{\text{OC}_2\text{H}_5}{\text{C}}\underset{\text{CH}_3}{\text{CH}_3}$ (d) none of these.

42. What is the product of the following sequence of reactions?

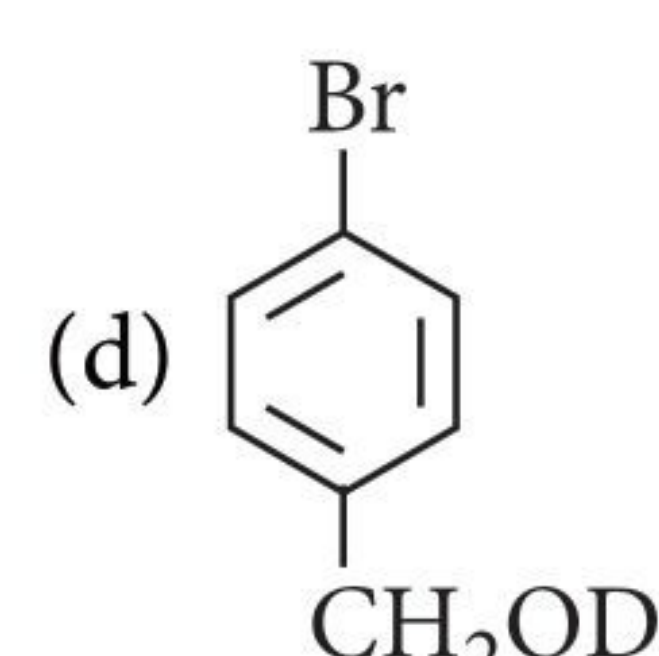
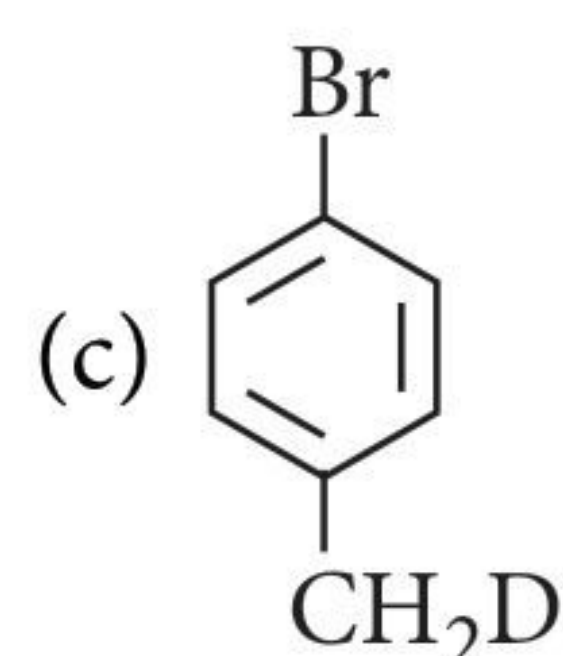


- (a) 2, 4-Dimethyl-3-pentanol
(b) 2, 3-Dimethyl-3-pentanol
(c) 2, 3-Dimethyl-2-pentanol
(d) 2, 2-Dimethyl-3-pentanol

43. The final product obtained in the reaction, is



- (a) $\text{p-D-CH}_2\text{Cl}$ (b) $\text{p-OD-CH}_2\text{Cl}$



44. 'Sulphan' is

- (a) a mixture of SO_3 and H_2SO_5
(b) 100% conc. H_2SO_4
(c) a mixture of gypsum and conc. H_2SO_4
(d) oleum (a mixture of SO_3 and H_2SO_4).

45. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion : Crystalline solids are anisotropic in nature.

Reason : Crystalline solids are not as closely packed as amorphous solids.

Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

46. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion : The solubility of a gas in a liquid increases with increase of pressure.

Reason : The solubility of a gas in a liquid is directly proportional to the pressure of the gas.

Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

47. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion : Grignard reagents are prepared in ethers but not in benzene.

Reason : Grignard reagents are soluble in benzene.

Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

48. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion : HClO_4 is a stronger acid than HClO_3 .

Reason : Oxidation state of chlorine in HClO_4 is +7 and in HClO_3 is +5.

Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

49. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion : Glucose gives a reddish-brown precipitate with Fehling's solution.

Reason : Reaction of glucose with Fehling's solution gives CuO and gluconic acid.

Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

SECTION - C

This section consists of 6 multiple choice questions with an overall choice to attempt any 5. In case more than desirable number of questions are attempted, ONLY first 5 will be considered for evaluation.

- 50.** Match the entries of List I with appropriate entries of List II and select the correct answer using the codes given below the lists :

List I

- P. Glycosidic linkage
- Q. Insulin
- R. Peptide bond
- S. Nucleotide

List II

- 1. Globular protein
- 2. Connects two monosaccharide units
- 3. Monomeric unit of nucleic acids
- 4. Connects two amino acid units

	P	Q	R	S
(a)	4	3	2	1
(b)	3	4	1	2
(c)	2	1	4	3
(d)	1	2	3	4

- 51.** Which of the following is not a correct analogy?

- (a) $r_+/r_- : < 0.155 :: \text{Geometry} : \text{Linear}$
- (b) $r_+/r_- : 0.155-0.225 :: \text{Geometry} : \text{Trigonal planar}$
- (c) $r_+/r_- : 0.225-0.525 :: \text{Geometry} : \text{Tetrahedral}$
- (d) $r_+/r_- : 0.73-1.0 :: \text{Geometry} : \text{Cubic}$

- 52.** Complete the following analogy.

A : Ethanol – Water mixture ::

B : Nitric acid – Water mixture

- (a) A : Negative deviation :: B : Positive deviation
- (b) A : Positive deviation :: B : Ideal solution
- (c) A : Negative deviation :: B : Ideal solution
- (d) A : Positive deviation :: B : Negative deviation

Read the passage given below and answer the following questions 53-55.

A chloro compound (A) on reduction with Zn-Cu and ethanol gives the hydrocarbon (B) with five carbon atoms. When (A) is dissolved in dry ether and treated with sodium metal it gave 2,2,5,5-tetramethylhexane. The treatment of (A) with alcoholic KCN gives compound (C).

- 53.** The compound (A) is

- (a) 1-chloro-2, 2-dimethylpropane
- (b) 1-chloro-2, 2-dimethylbutane
- (c) 1-chloro-2-methylbutane
- (d) 2-chloro-2-methylbutane.

- 54.** The compound (C) is

- (a) $(\text{CH}_3)_2\text{CHCH}_2\text{CN}$
- (b) $(\text{CH}_3)_3\text{CNH}_2$
- (c) $(\text{CH}_3)_3\text{CCH}_2\text{CN}$
- (d) $(\text{CH}_3)_3\text{CCH}_2\text{CONH}_2$

- 55.** The reaction of (A) with Na metal in dry ether is called

- (a) Gilman reaction
- (b) Wurtz reaction
- (c) Wurtz-Fittig reaction
- (d) Swart's reaction.

SAMPLE OMR SHEET

General Instructions

- Details of the candidates will be pre-filled in the OMR.
- Candidate has to write a Question Paper Code in the upper right corner in the space provided for the same. Question Paper Code will be written on the Question Paper.
- Candidate has to write in his/her own hand in the space provided "I confirm that all particulars given above are correct" and sign in the running hand on OMR.
- Only Blue/Black ball point pen is to be used for filling desired information and for giving responses.
- Use of pencil is strictly prohibited.

Important features of the OMR:

- There is a space for answering 60 questions in an OMR irrespective of total questions given in the Question Papers of any subject.
- Answers given after the maximum question number in your question paper will not be evaluated.

उत्तर पत्रिका / ANSWER SHEET

केवल नीले/काले बॉल प्वाइंट पेन का ही प्रयोग करें।
USE ONLY BLUE/BLACK BALL POINT PEN

अनुक्रमांक Roll No.	
(अंकों में एवं शब्दों में) (in digits and words)	
परीक्षा का दिन एवं तिथि Day & Date of the Examination	Tuesday & 14-12-2021
केन्द्र संख्या व नाम Center No. & Name	
विषय कोड व नाम Subject code & Name	043 & Chemistry
अभ्यर्थी का नाम Candidate's Name	
पिता का नाम Father's Name	
विद्यालय का कोड व नाम School code and Name	

अधीक्षक की मोहर / Facsimile stamp of the Center Supdt.
--

उच्च माध्यमिक विद्यालय परीक्षा (कक्षा बारहवीं) Senior Secondary School Examination (Class XII)

	OMR No.
प्रश्न पत्र के ऊपर लिखे कोड को दर्शाएँ Write code No. written on the question paper Question Paper Code <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div>	
SOME EXAMPLES OF WRONG/CORRECT WAYS OF MARKING AS FOLLOWS	
WRONG METHOD	CORRECT METHOD
1 <input checked="" type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/>	1 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
2 <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/>	2 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
3 <input type="radio"/> <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/>	3 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
4 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	4 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
5 <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/>	5 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
6 <input type="radio"/> <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/>	6 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
7 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	7 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
8 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	8 <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>

प्रत्येक प्रश्न का उत्तर केवल एक ही गोले में गहरा निशान लगाकर दीजिए एवं उत्तर को बॉक्स में लिखें Darken **ONLY ONE CIRCLE** for each Question and write the answer in the box.

Q.No.	Response	*	#
1	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		①
2	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		②
3	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		③
4	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		④
5	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑤
6	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑥
7	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑦
8	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑧
9	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑨
10	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑩
11	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑪
12	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑫
13	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑬
14	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑭
15	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑮

* Write Correct Option

Q.No.	Response	*	#
16	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑯
17	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑰
18	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑱
19	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑲
20	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑳
21	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉑
22	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉒
23	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉓
24	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉔
25	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉕
26	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉖
27	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉗
28	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉘
29	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉙
30	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉚

Darken Circle if question not attempted

Q.No.	Response	*	#
31	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉛
32	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉜
33	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉝
34	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉞
35	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㉟
36	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊱
37	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊲
38	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊳
39	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊴
40	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊵
41	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊶
42	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊷
43	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊸
44	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊹
45	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊺

Q.No.	Response	*	#
46	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊻
47	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊼
48	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊽
49	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊾
50	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		㊿
51	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		①
52	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		②
53	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		③
54	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		④
55	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑤
56	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑥
57	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑦
58	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑧
59	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑨
60	<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d		⑩

I confirm that all particulars given above are correct.		अभ्यर्थी के हस्ताक्षर (चलते हाथ से लिखें) Candidate's Signature (in running hand)
---	--	--

Total correct answers (To be filled by the Evaluator)	<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>
--	---

Total correct answers (To be filled by the Coordinator)	<div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div>
--	---

For more details visit cbse.gov.in

SOLUTIONS

1. (b) : According to Raoult's law, relative lowering of vapour pressure,

$$\frac{p_A^\circ - p_s}{p_A^\circ} = x_B \quad \dots(i)$$

$$x_B = \frac{n_B}{n_B + n_A} = \frac{W_B/M_B}{\frac{W_B}{M_B} + \frac{W_A}{M_A}} \quad \dots(ii)$$

Given vapour pressure is reduced to 80% when non-volatile solute is dissolved in octane *i.e.*, if $p_A^\circ = 1$ atm then $p_s = 0.8$ atm; $p_A^\circ - p_s = 0.2$ atm;

$M_A(\text{C}_8\text{H}_{18}) = 114 \text{ g mol}^{-1}$; $W_A = 114 \text{ g}$;

$M_B = 40 \text{ g mol}^{-1}$; $W_B = ?$

From eq. (i) and (ii),

$$\frac{0.2}{1} = \frac{W_B/40}{\frac{W_B}{40} + \frac{114}{114}} = \frac{W_B/40}{\frac{W_B}{40} + 1} \Rightarrow 0.2 = \frac{W_B}{W_B + 40}$$

$$0.2W_B + 8 = W_B \Rightarrow W_B = 10 \text{ g}$$

2. (a) : $\Delta T_f = K_f \cdot m$

$$= 1.86 \times \frac{1.8}{180} \times \frac{1}{2} = 0.0093^\circ\text{C} \quad (K_f \text{ for water} = 1.86)$$

$$T_f = T_f^\circ - \Delta T_f = 0 - 0.0093 = -0.0093^\circ\text{C}$$

3. (c) : Number of Cu atoms per unit cell

$$= \frac{1}{8} \times 8 + \frac{1}{2} \times 6 = 4$$

[Cu atoms are at faces and corners of the cube]

$$\text{Number of Ag atoms per unit cell} = \frac{1}{4} \times 12 = 3$$

Number of Au atoms per unit cell = 1 (at body centre)

So, there are 4 Cu atoms, 3 Ag atoms and 1 Au atom in a unit cell.

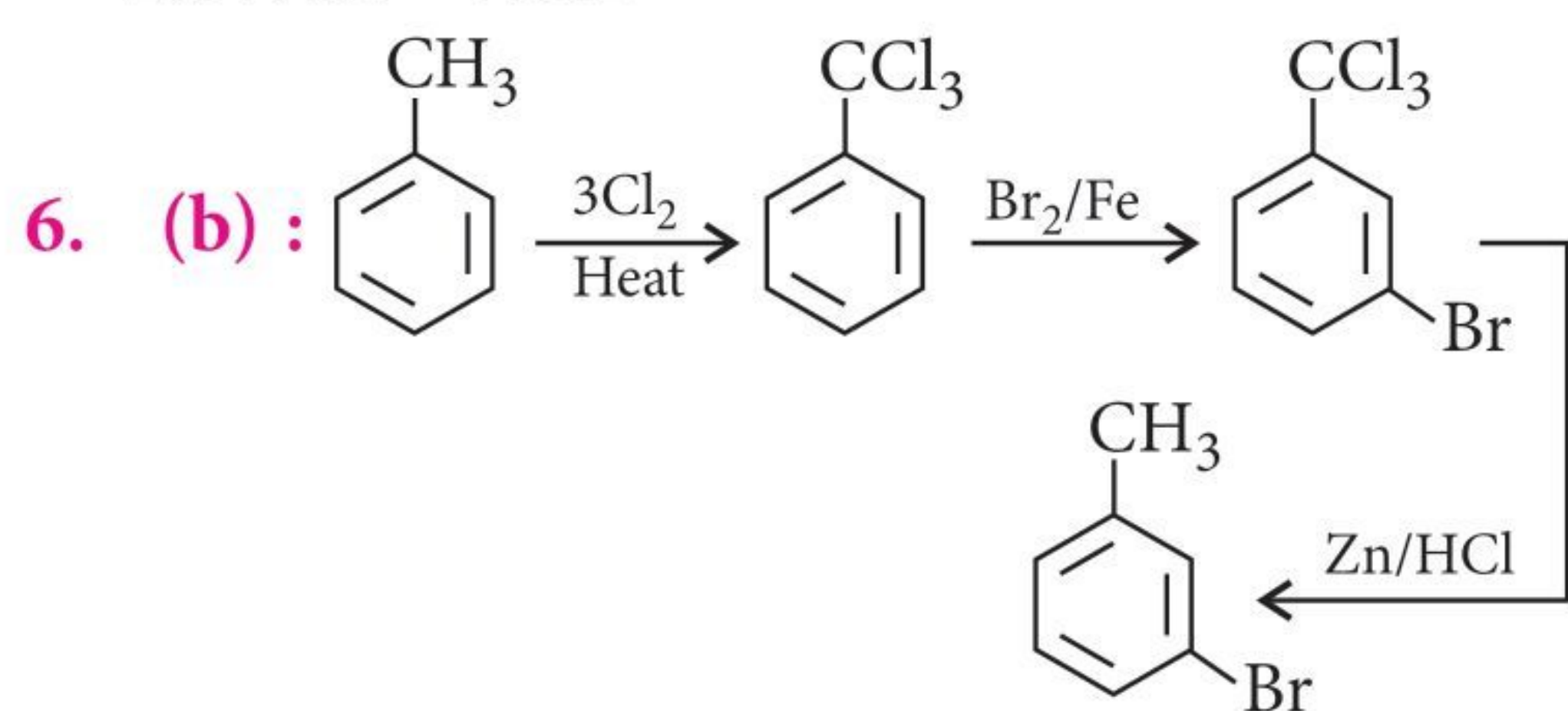
Hence, the formula of alloy is $\text{Cu}_4\text{Ag}_3\text{Au}$.

4. (a)

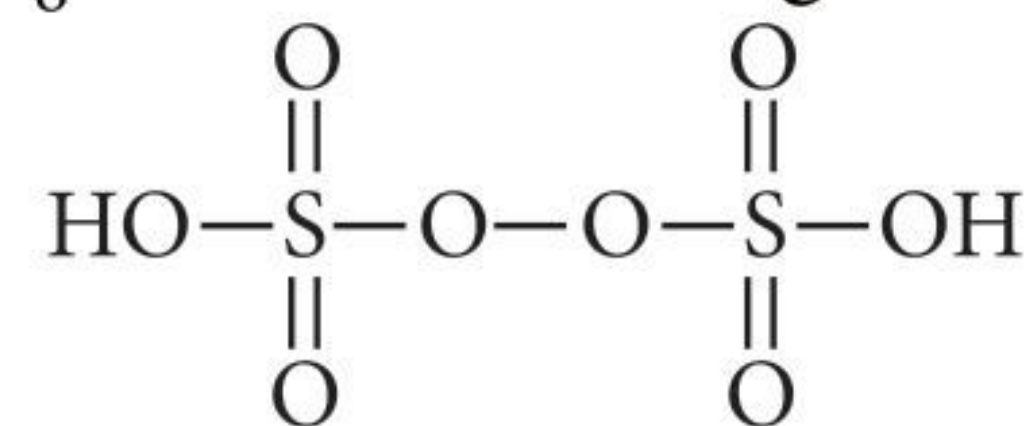
5. (d) : We know that $\pi V = nRT$, where $n = \frac{w}{M}$

$$\pi V = \frac{w}{M} RT, \quad M = \frac{wRT}{\pi V} = \frac{1.26 \times 0.083 \times 300}{2.57 \times 10^{-3} \times \frac{200}{1000}}$$

$$= \frac{1.26 \times 0.083 \times 300}{2.57 \times 10^{-3} \times 0.2} = 61038.91 \approx 61038 \text{ g mol}^{-1}$$



7. (c) : $\text{H}_2\text{S}_2\text{O}_8$ has the following structure:



This is known as Marshall's acid. It contains O—O bond.

8. (d) : Let the units of ferrous oxide in a unit cell = n .
Molecular weight of ferrous oxide (FeO)

$$= 56 + 16 = 72 \text{ g mol}^{-1}$$

$$\text{Weight of } n \text{ units} = \frac{72 \times n}{6.023 \times 10^{23}}$$

$$\text{Density} = \frac{\text{Wt. of unit cell}}{\text{Volume}}$$

$$4.09 = \frac{72 \times n}{6.023 \times 10^{23} \times 125 \times 10^{-24}}$$

$$\text{Hence, } n = 4.27 \approx 4$$

$$\text{9. (c) : } \frac{\Delta p_1}{\Delta p_2} = \frac{x_{1(\text{solute})}}{x_{2(\text{solute})}} \Rightarrow x_{2(\text{solute})} = \frac{20}{10} \times 0.1 = 0.2$$

$$x_{\text{solvent}} = 1 - 0.2 = 0.8$$

10. (b)

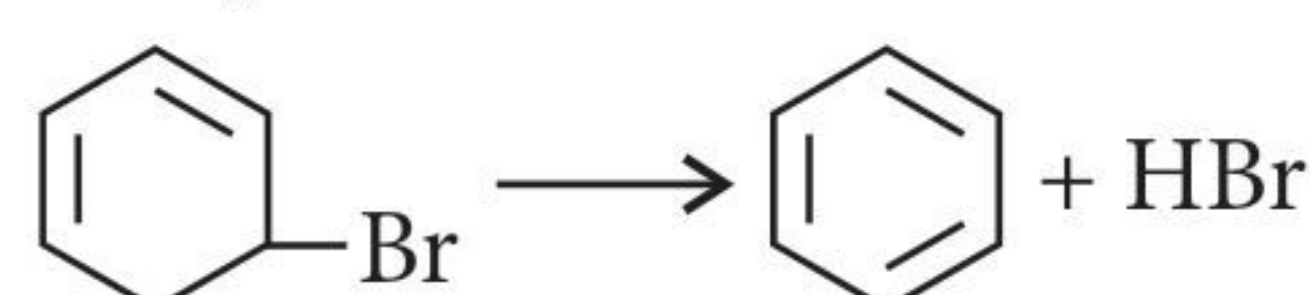
$$\text{11. (a) : } \Delta T_f = T_f^\circ - T_f = 0 - (-0.186) = 0.186^\circ\text{C}$$

$$\Delta T_f = K_f \times m \Rightarrow m = \frac{\Delta T_f}{K_f} = \frac{0.186}{1.86} = 0.1 \text{ m}$$

$$\Delta T_b = K_b \times m = 0.521 \times 0.1 = 0.0521 \text{ K}$$

12. (c)

13. (c) : Due to formation of a stable aromatic compound (c) will be debrominated readily.



14. (a) : There is no chiral carbon, hence inversion does not take place.

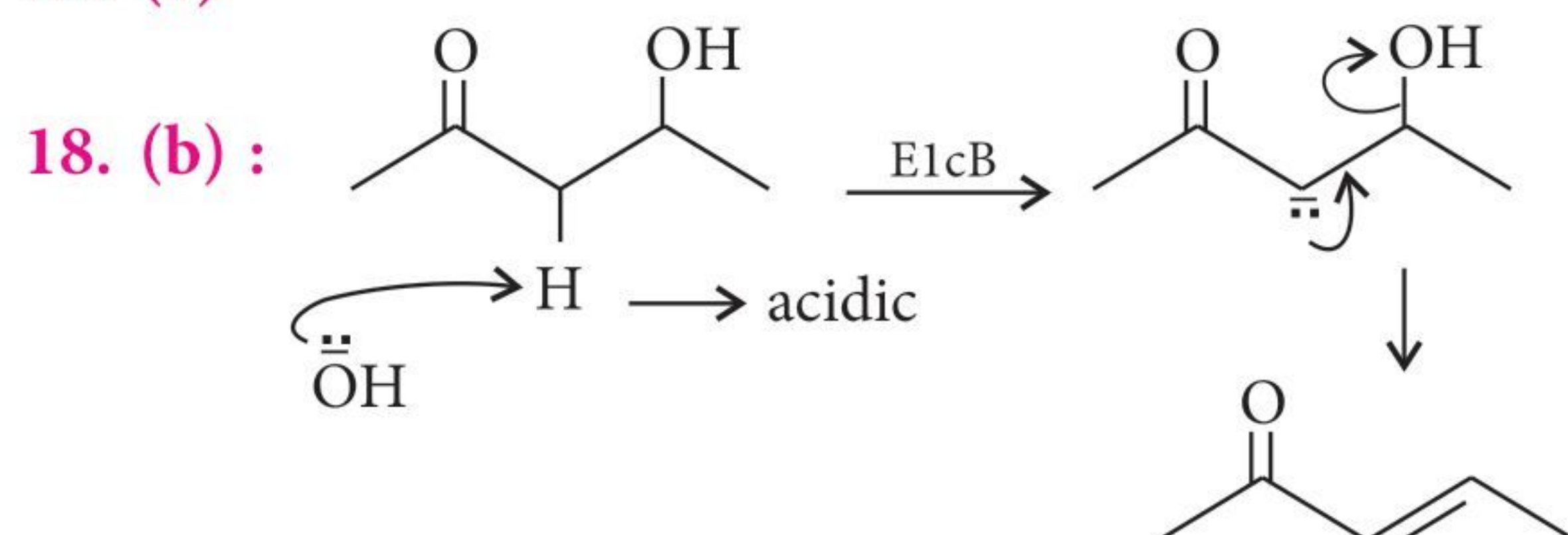
15. (c) : The order of reactivity of alcohols towards Lucas reagent is $3^\circ \text{ alcohol} > 2^\circ \text{ alcohol} > 1^\circ \text{ alcohol}$.

1° alcohols do not react with Lucas reagent at room temperature. It requires high temperature.

The benzyl and allyl alcohols react as rapidly as 3° alcohols with Lucas reagent because their cations are resonance stabilised and as stable as 3° cations.

16. (b) : NaBH_4 does not reduce ester.

17. (a)



$\ddot{\text{O}}\text{H}$ is not a very good leaving group but expulsion of this becomes easy due to the formation of conjugated structure.

19. (c) : Catenation tendency is higher in phosphorus as compared with other elements of the same group.

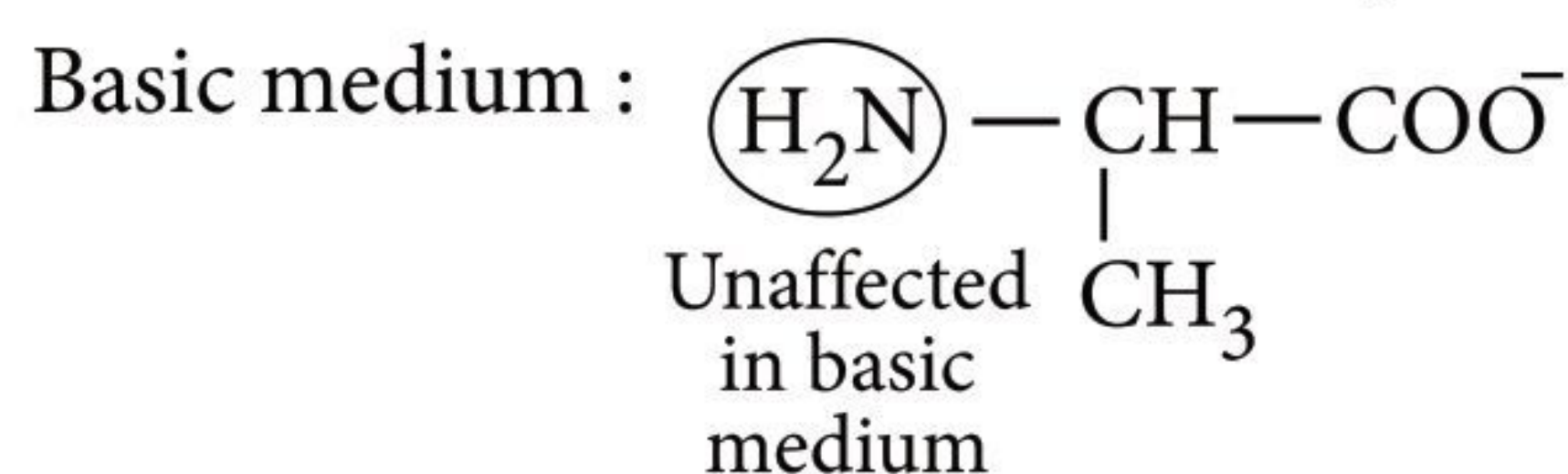
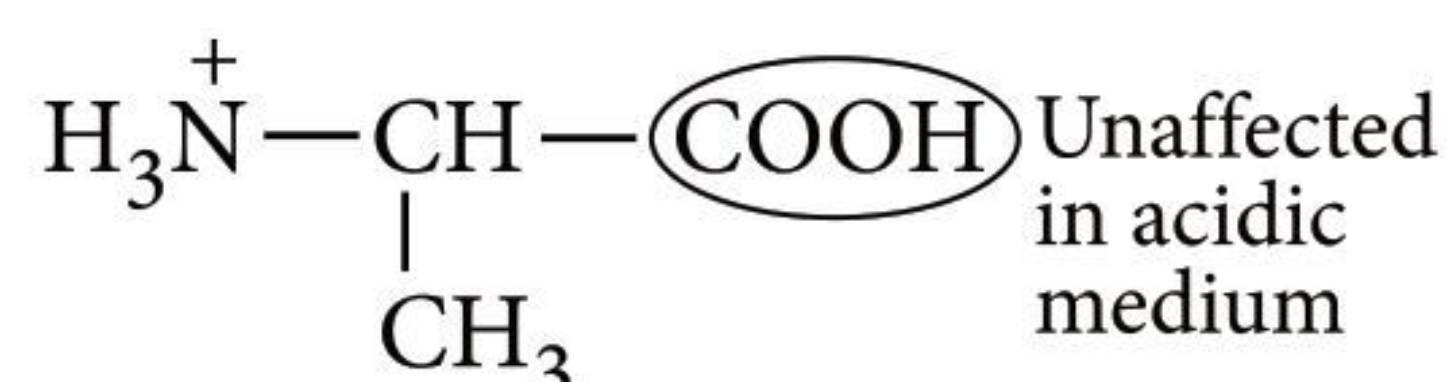
20. (b) : According to Raoult's law,

$$P_{\text{total}} = p_A + p_B = p_A^\circ x_A + p_B^\circ x_B$$

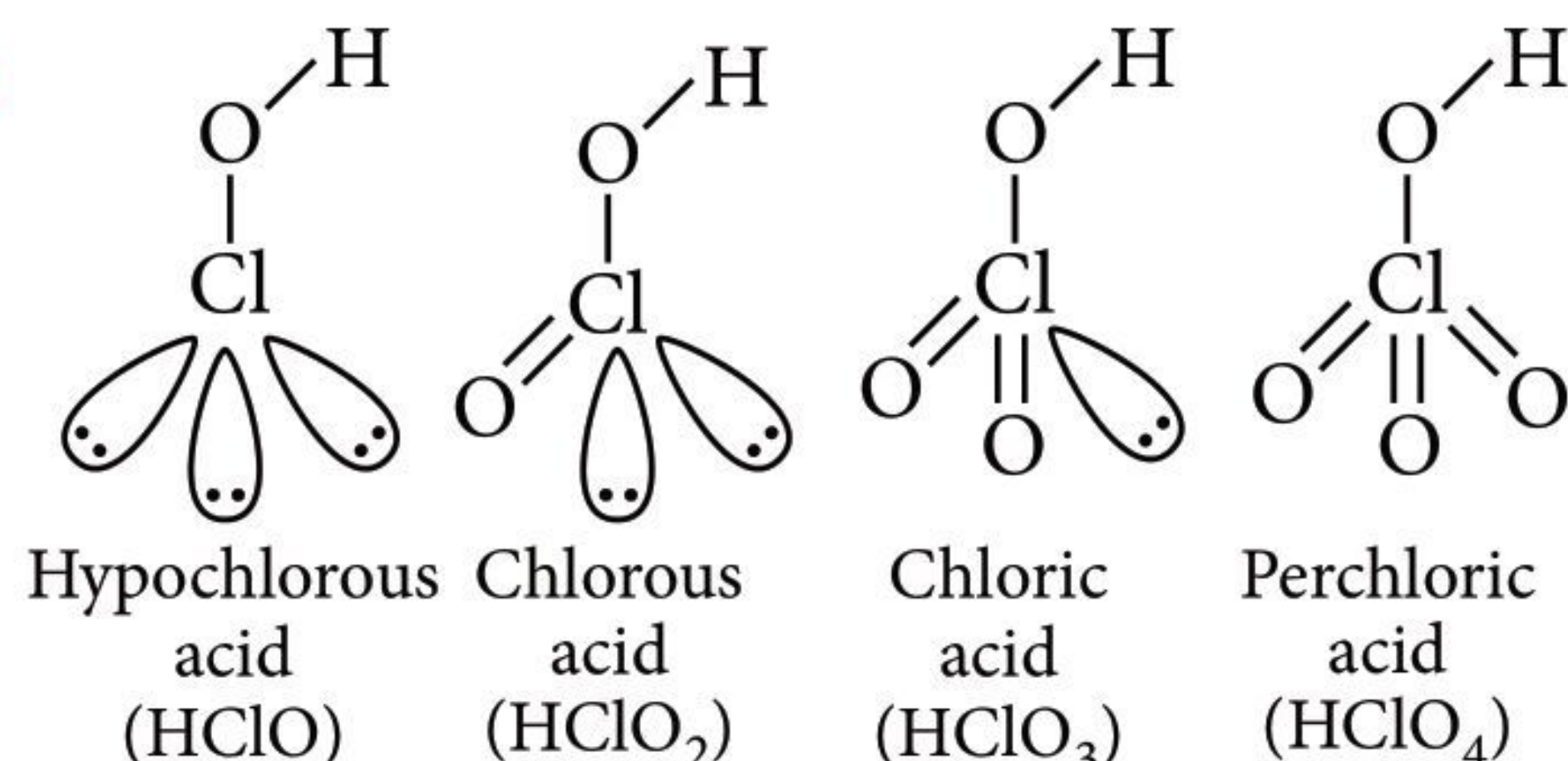
$$290 = p_A^\circ \times (0.6) + 200 \times (1 - 0.6)$$

$$290 = 0.6 \times p_A^\circ + 0.4 \times 200 \Rightarrow p_A^\circ = 350 \text{ mm}$$

21. (a) : Acidic medium :

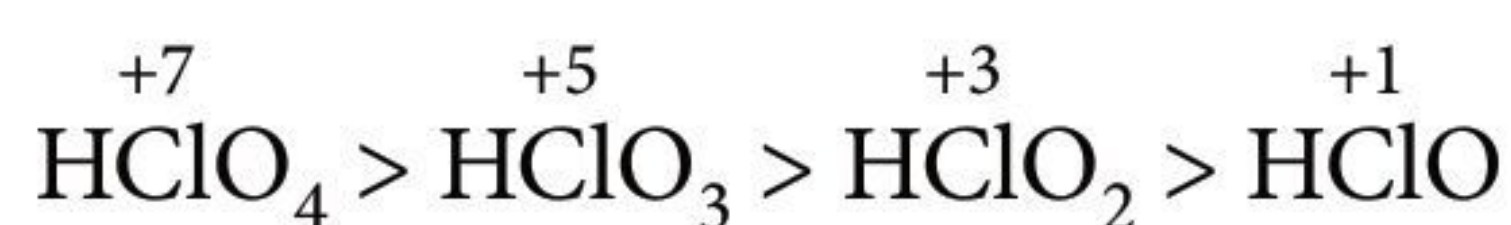


22. (b) :



In all these oxoacids, Cl is sp^3 -hybridized.

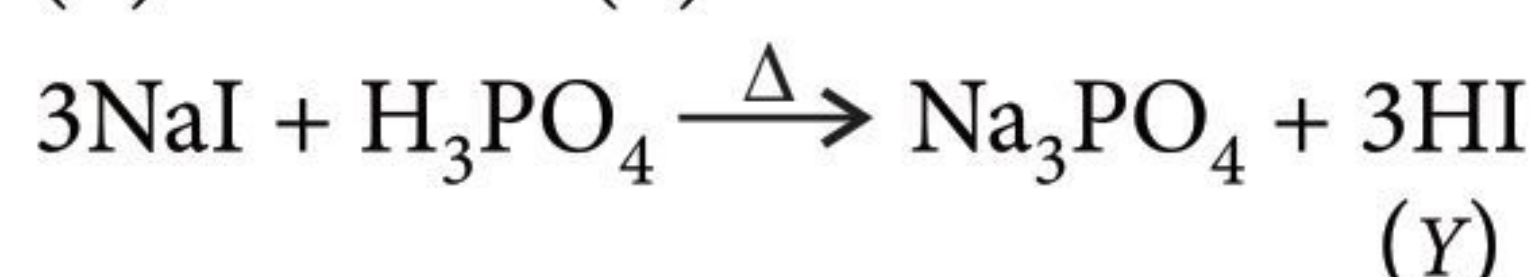
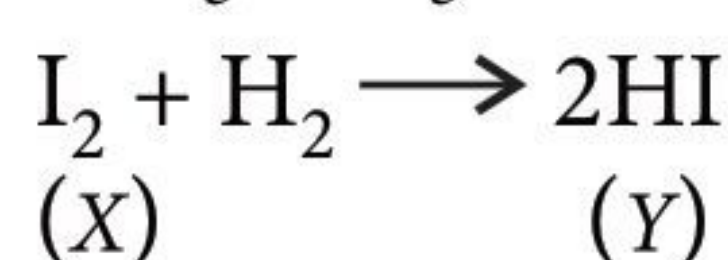
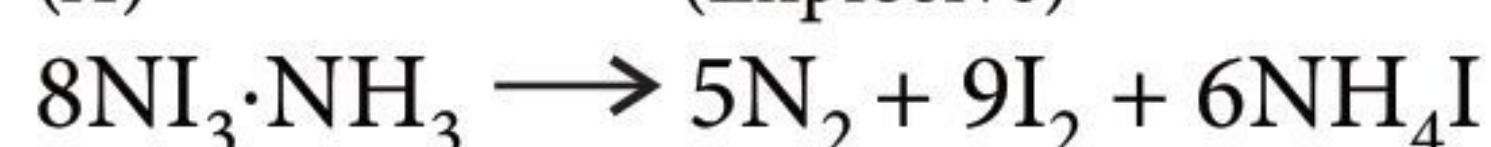
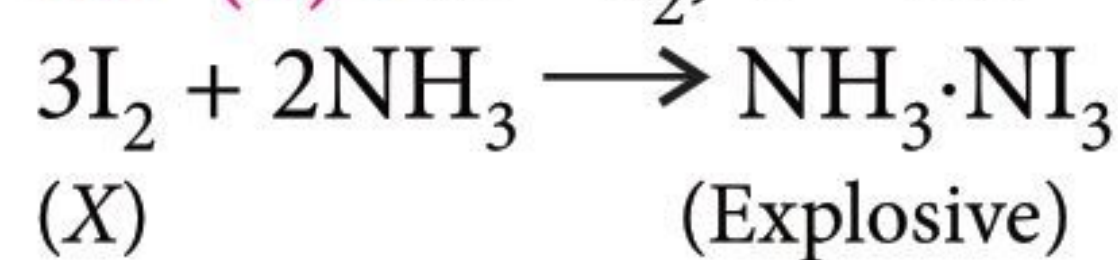
Acid strength of oxoacids of the same halogen decreases with decrease in oxidation number of the halogen, e.g. ,



23. (b) : When one of the alkyl groups is 3° and another is 1° , nature of reagent determines the type of mechanism (S_N1 or S_N2). A polar solvent or reagent capable of forming ions (*viz.* conc. HI) will cause S_N1 reaction, while a non-polar solvent or a reagent which is not capable of forming ions (*viz.* anhy. HI) will cause S_N2 reaction.

24. (b) : The sugar molecule found in RNA is β -D-ribose while the sugar in DNA is β -D-2-deoxyribose. The sugar β -D-2-deoxyribose differs from ribose only in the substitution of hydrogen for an $-\text{OH}$ group at 2-position.

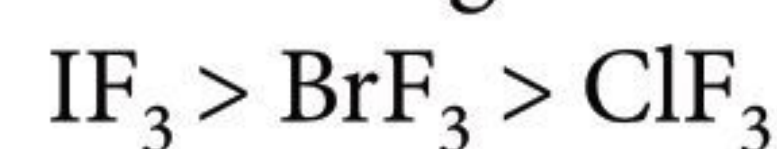
25. (d) : $X = \text{I}_2$, $Y = \text{HI}$



26. (a) : M^{2+} ions in *ccp* arrangement has 4 atoms per unit cell. Now, for MX_2 type salt, number of X^- ions per unit cell is 8. Also, the number of tetrahedral voids for *ccp* arrangement is 8 so, X^- ions occupy 100% of tetrahedral voids. MX_2 type salt with such arrangement is a fluorite type structure in which coordination number for cations is 8 and for anions is 4.

27. (c) : Raoult's law is applicable to a solution which is dilute, and solution containing solute which does not associates or dissociates.

28. (a) : The stability of interhalogen compounds decreases as the size of central atom decreases due to decreases in electronegativity difference. Hence, the stability of interhalogen compounds follows the order :



29. (b)

30. (a) : In RNA molecule, uracil (U) is the complementary base of adenine (A) and cytosine (C) is the complementary base of guanine (G).

31. (b) : For *fcc*, $a = 2\sqrt{2}r = 2 \times \sqrt{2} \times 300 \text{ pm}$
 $= 848.5 \text{ pm}$

32. (c) : They are isomers differ in configuration at C-1.

33. (c) : The total pressure will be the sum of pressures of air and benzene.

34. (b) : Given, $P_{\text{heptane}}^\circ = 105 \text{ kPa}$

$$P_{\text{octane}}^\circ = 45 \text{ kPa}, w_{\text{heptane}} = 25 \text{ g}, w_{\text{octane}} = 35 \text{ g}$$

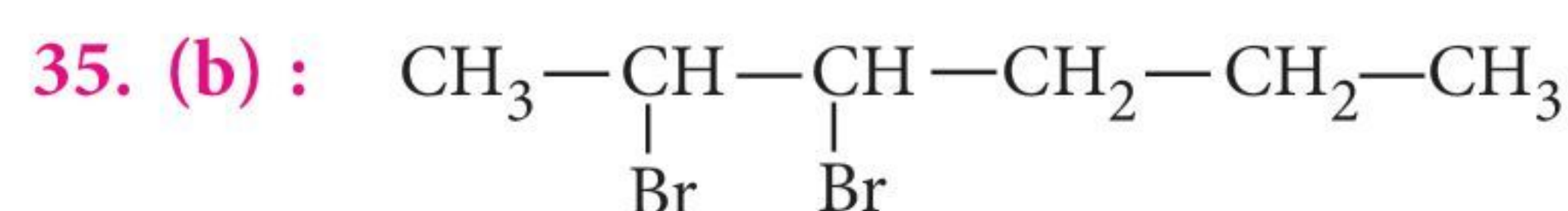
$$n_{\text{heptane}} = \frac{25}{100} = 0.25 \Rightarrow n_{\text{octane}} = \frac{35}{114} = 0.30$$

$$x_{\text{heptane}} = \frac{0.25}{0.25 + 0.30} = 0.45$$

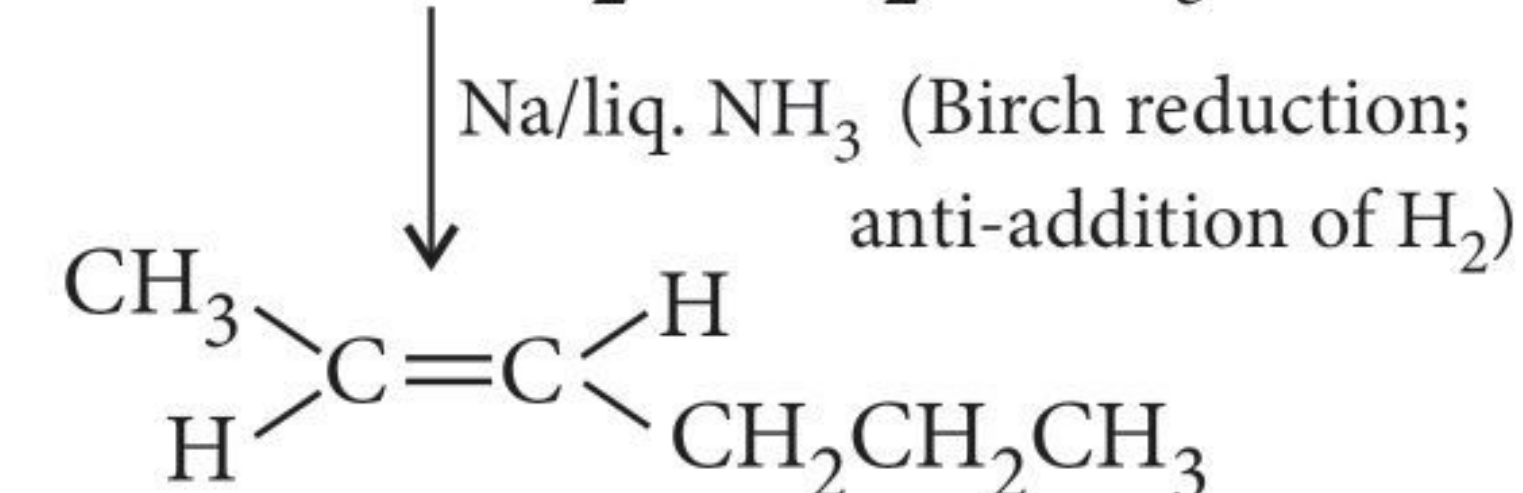
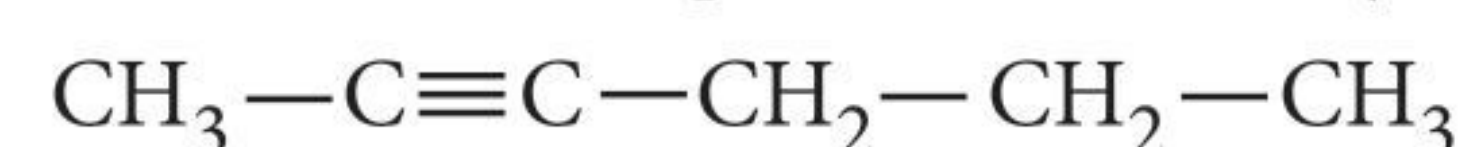
$$x_{\text{octane}} = \frac{0.30}{0.25 + 0.30} = 0.55$$

$$P_{\text{Total}} = x_{\text{heptane}} P_{\text{heptane}}^\circ + x_{\text{octane}} P_{\text{octane}}^\circ$$

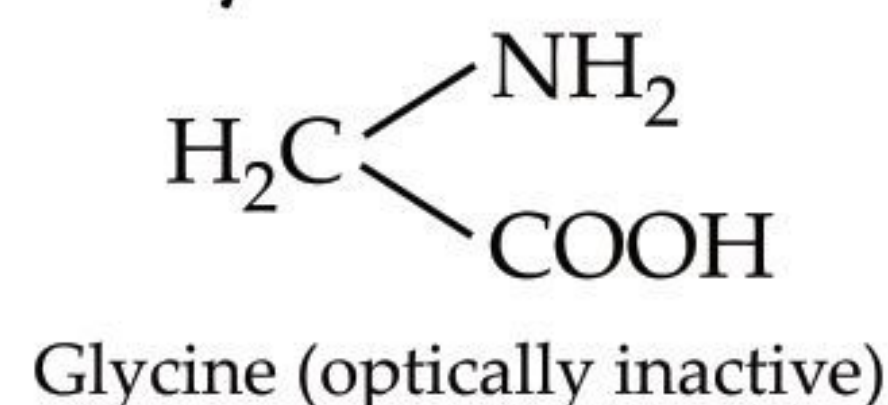
$$= 0.45 \times 105 + 0.55 \times 45 = 47.25 + 24.75 = 72 \text{ kPa}$$



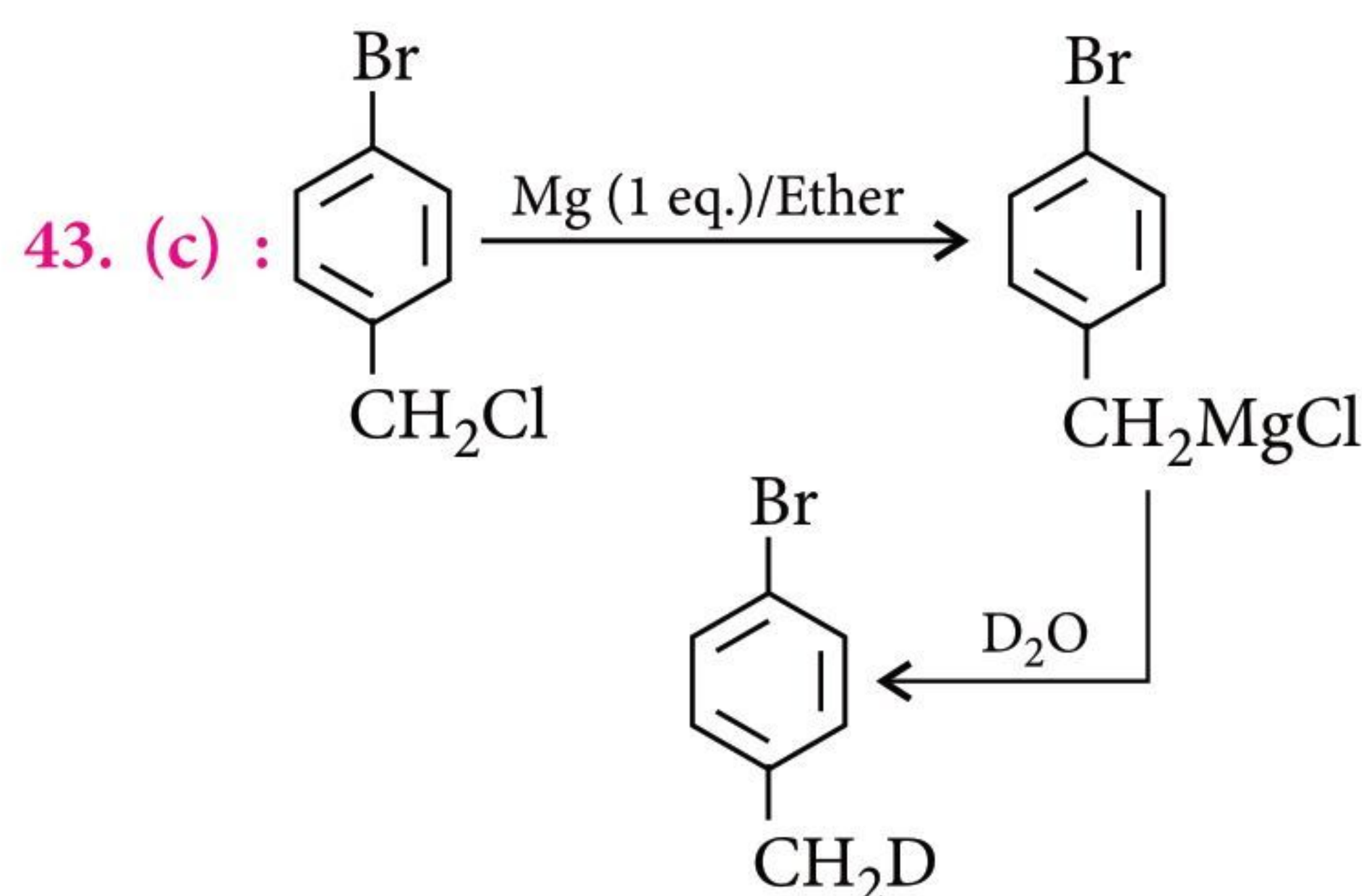
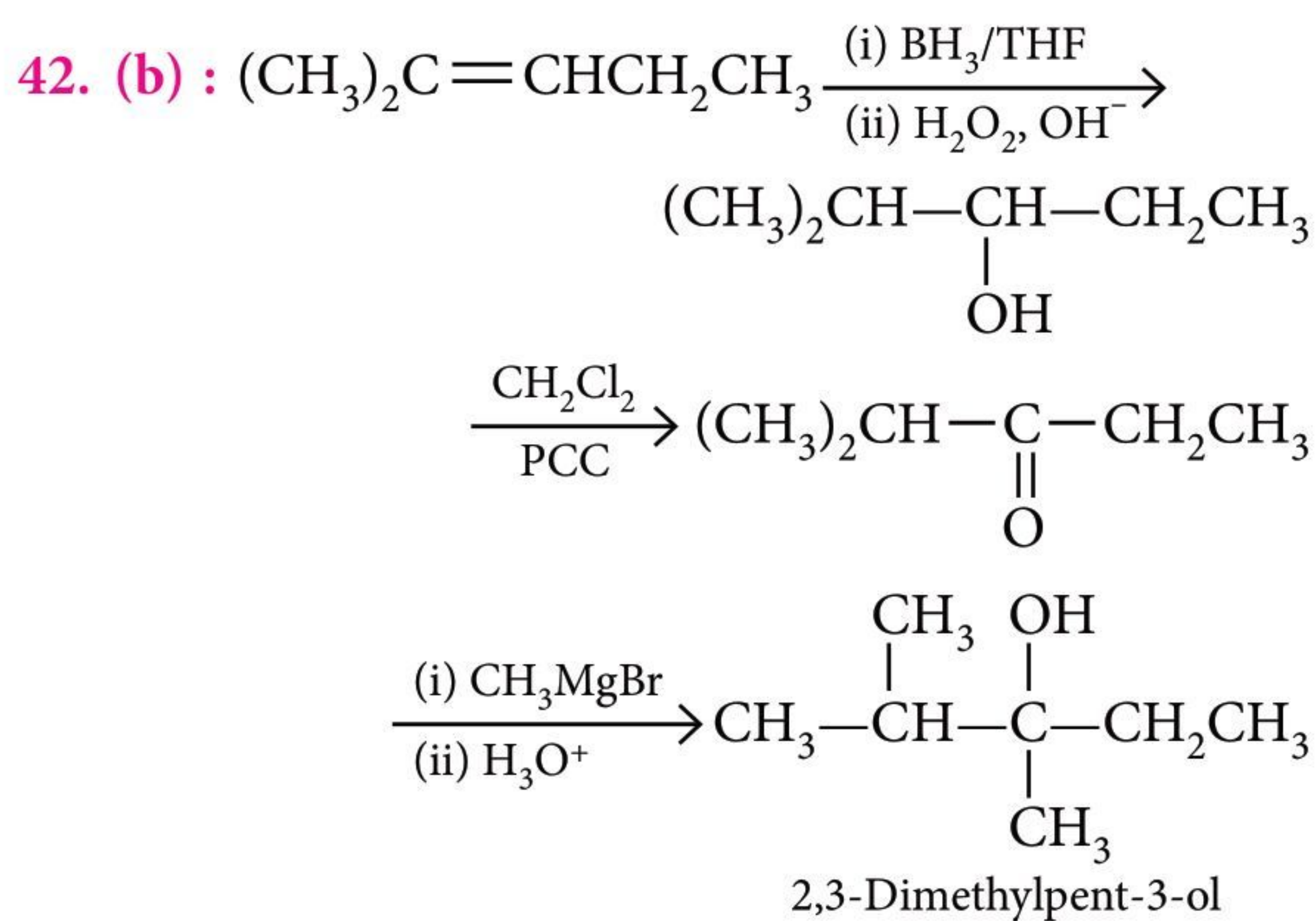
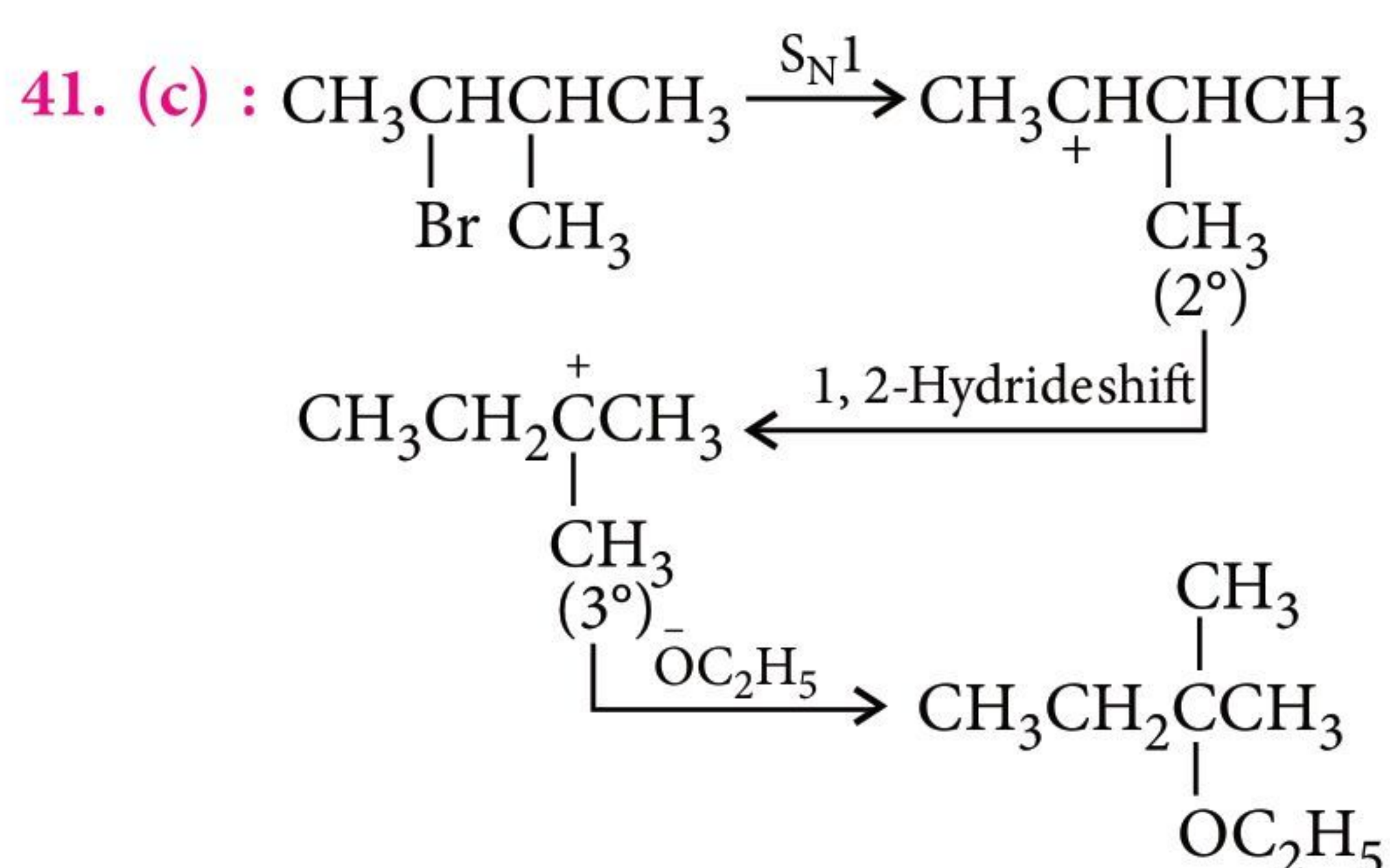
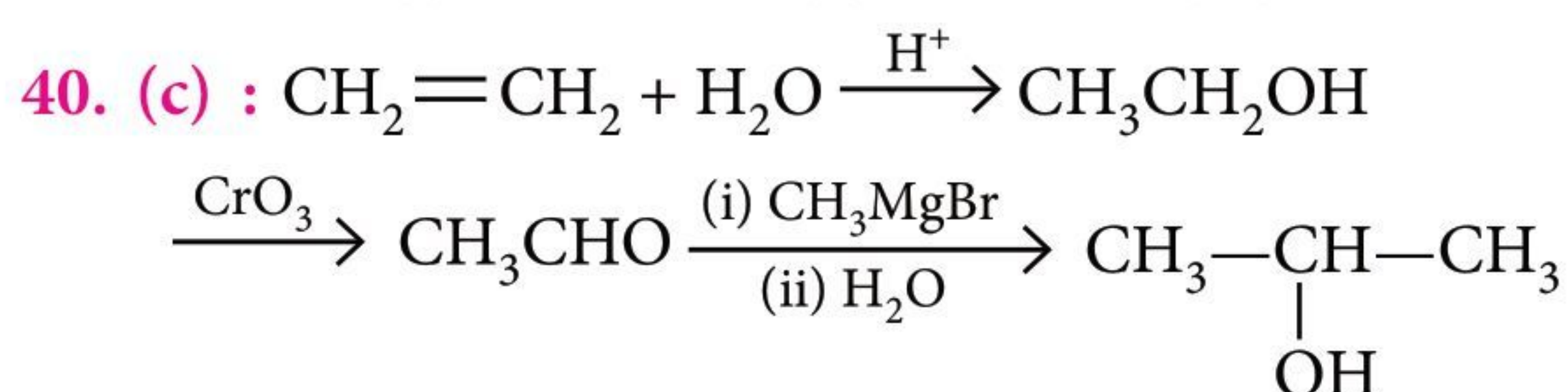
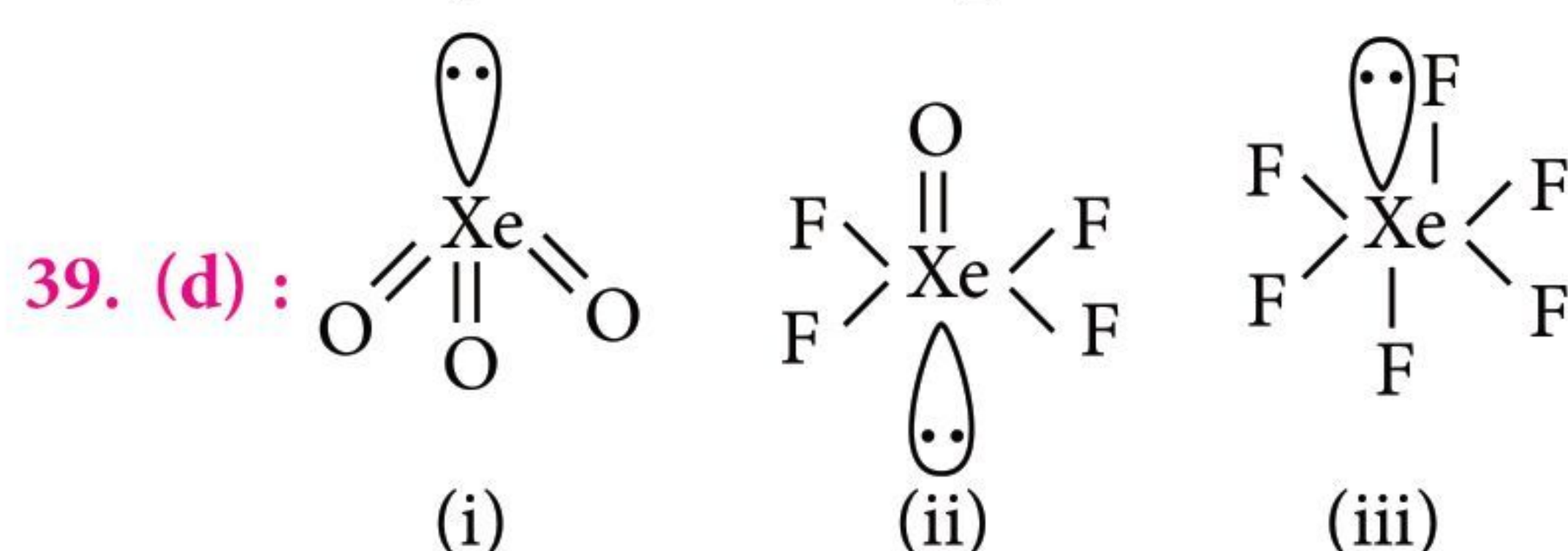
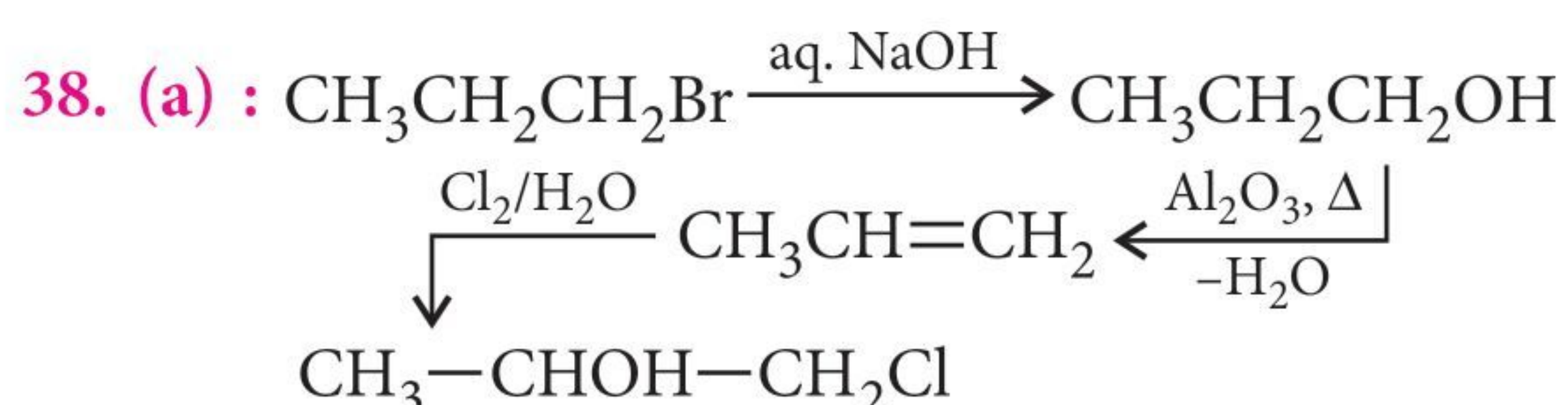
\downarrow NaNH_2 , E2 elimination (NaNH_2 will perform double dehydrohalogenation)



36. (b) : Glycine is optically inactive while all other amino acids are optically active.



37. (d) : It is evident from the arrangement that B occupies octahedral voids and thus, coordination number is six.



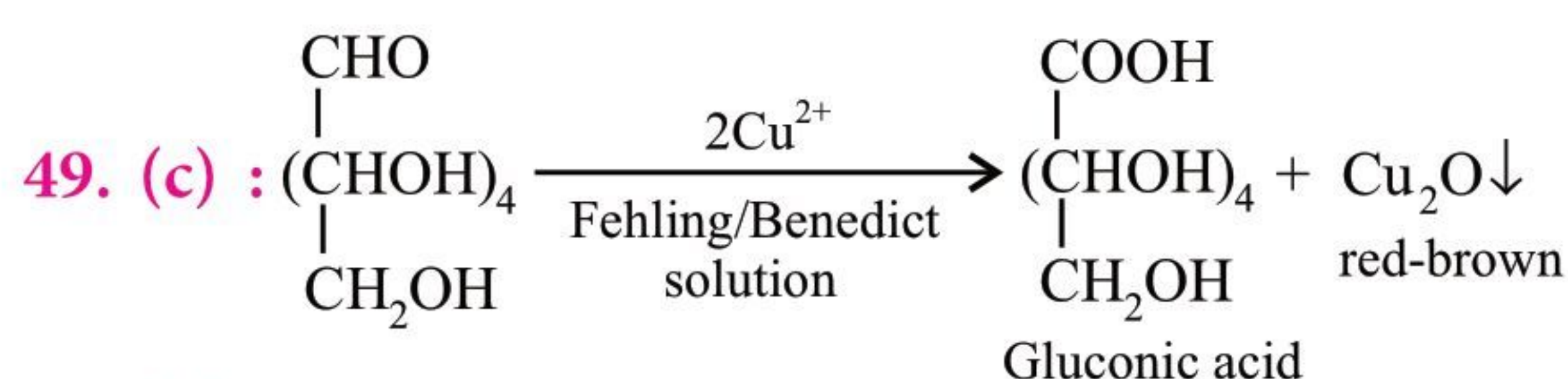
44. (d)

45. (c) : Crystalline solids are anisotropic and undergo a clean cleavage. The constituent particles are arranged in a definite and orderly pattern through the entire three dimensional space.

46. (a) : This is according to Henry's law which states that the solubility of a gas in given volume of a liquid at a particular temperature is directly proportional to the pressure of gas above the liquid.

47. (c) : Grignard reagents are soluble in ether but not in benzene.

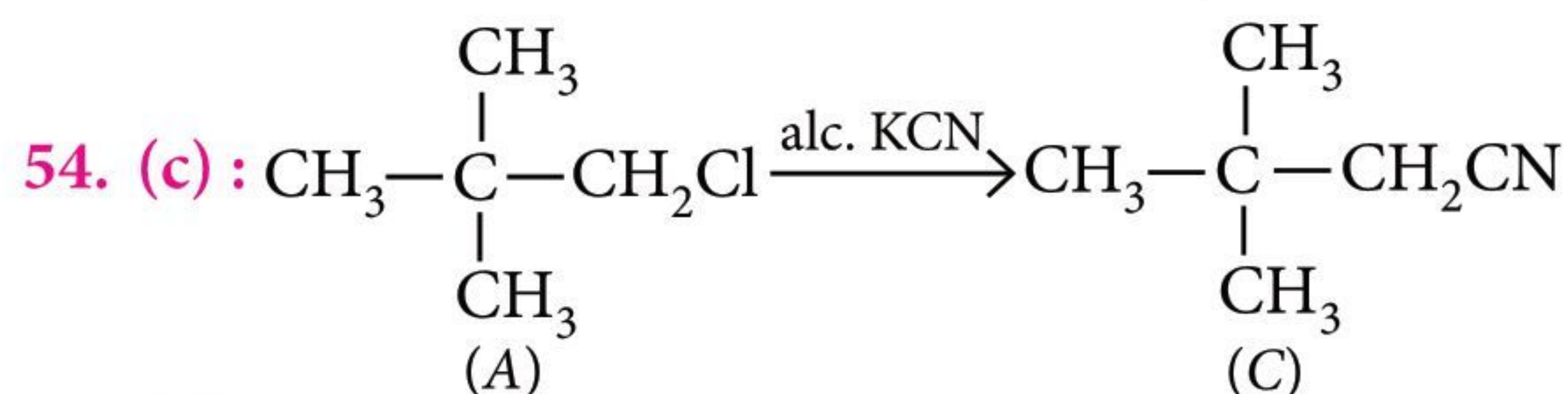
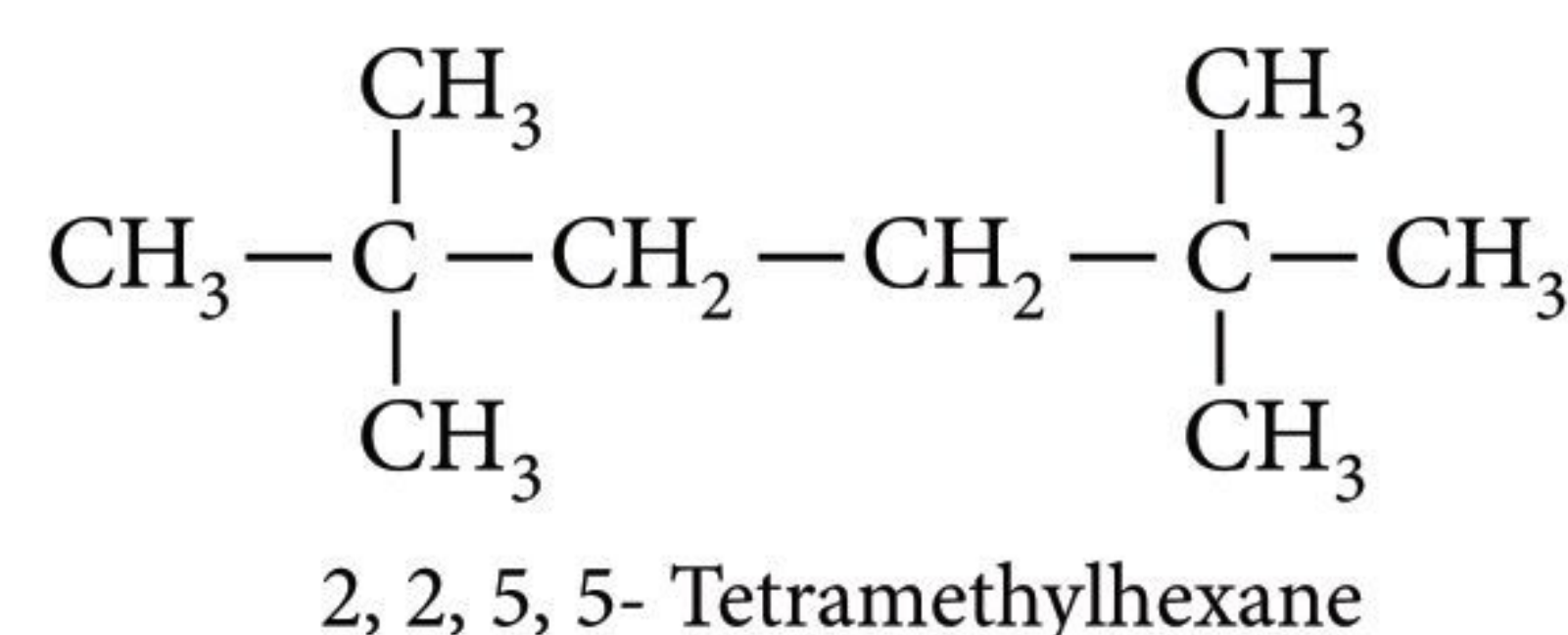
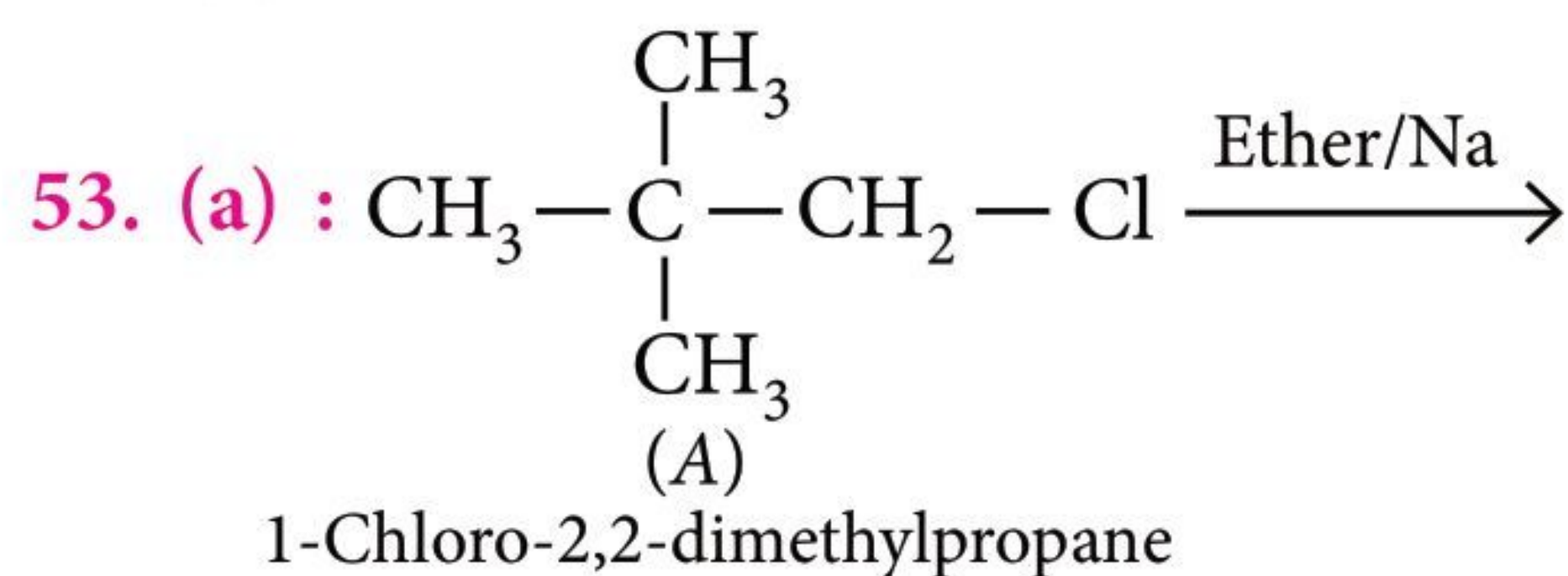
48. (b)



50. (c)

51. (c) : $r_+/r_- : 0.225 - 0.414$ Tetrahedral

52. (d)



55. (b)



LEARN FAST

IUPAC Nomenclature of Organic Compounds

The IUPAC System of Nomenclature

- A systematic name of an organic compound is generally derived by identifying the parent hydrocarbon and the functional group(s) attached to it.
 - By further using prefixes and suffixes, the parent name can be modified to obtain the actual name.
 - Compounds containing carbon and hydrogen only are called hydrocarbons.
 - A hydrocarbon is termed saturated if it contains only carbon-carbon single bonds. The IUPAC name for a homologous series of such compounds is alkane. Paraffin (Latin : little affinity) was the earlier name given to these compounds.
 - Unsaturated hydrocarbons are those, which contain at least one carbon-carbon double bond (alkenes) or triple bond (alkynes).

IUPAC Nomenclature of Alkanes

- **Straight chain hydrocarbons :** The names of such compounds are based on their chain structure and end with suffix '-ane' and carry a prefix indicating the number of carbon atoms present in the chain (except from CH_4 to C_4H_{10} , where the prefixes are derived from trivial names).
- The alkanes which differ from each other by merely the number of $-\text{CH}_2$ groups in the chain are called homologues. Few examples are given in the table:

Name	Root	Formula	Name	Root	Formula
methane	meth	CH_4	undecane	undec	$\text{C}_{11}\text{H}_{24}$
ethane	eth	C_2H_6	dodecane	dodec	$\text{C}_{12}\text{H}_{26}$
propane	prop	C_3H_8	tridecane	tridec	$\text{C}_{13}\text{H}_{28}$
butane	but	C_4H_{10}	tetradecane	tetradec	$\text{C}_{14}\text{H}_{30}$
pentane	pent	C_5H_{12}	pentadecane	pentadec	$\text{C}_{15}\text{H}_{32}$

hexane	hex	C_6H_{14}	icosane	icos	$\text{C}_{20}\text{H}_{42}$
heptane	hept	C_7H_{16}	heneicosane	heneicos	$\text{C}_{21}\text{H}_{44}$
octane	oct	C_8H_{18}	docosane	docos	$\text{C}_{22}\text{H}_{46}$
nonane	non	C_9H_{20}	triacontane	triacont	$\text{C}_{30}\text{H}_{62}$
decane	dec	$\text{C}_{10}\text{H}_{22}$	pentacontane	pentacont	$\text{C}_{50}\text{H}_{102}$

- **Branched chain hydrocarbons :** In a branched chain compound, small chains of carbon atoms are attached at one or more carbon atoms of the parent chain. The small carbon chains (branches) are called alkyl groups.
 - In order to name such compounds, the names of alkyl groups are prefixed to the name of the parent alkane.
 - The name of an unbranched alkyl substituent is derived by replacing **ane** by **yl**.

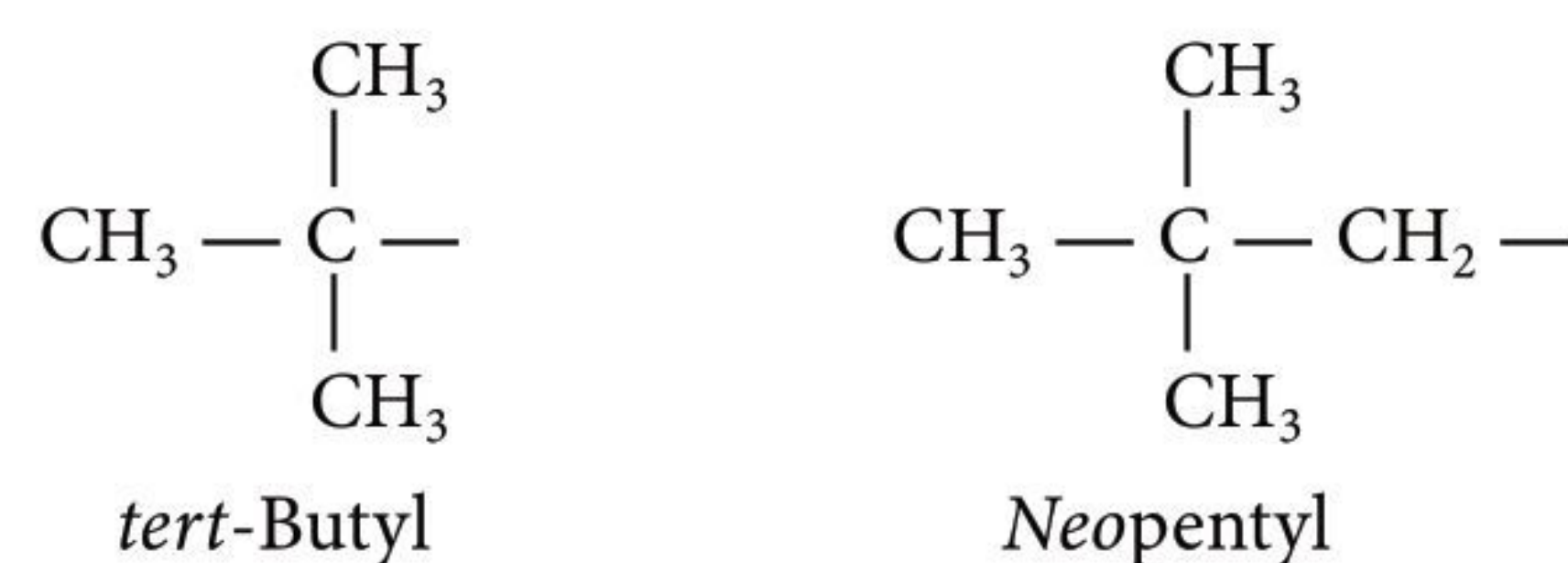
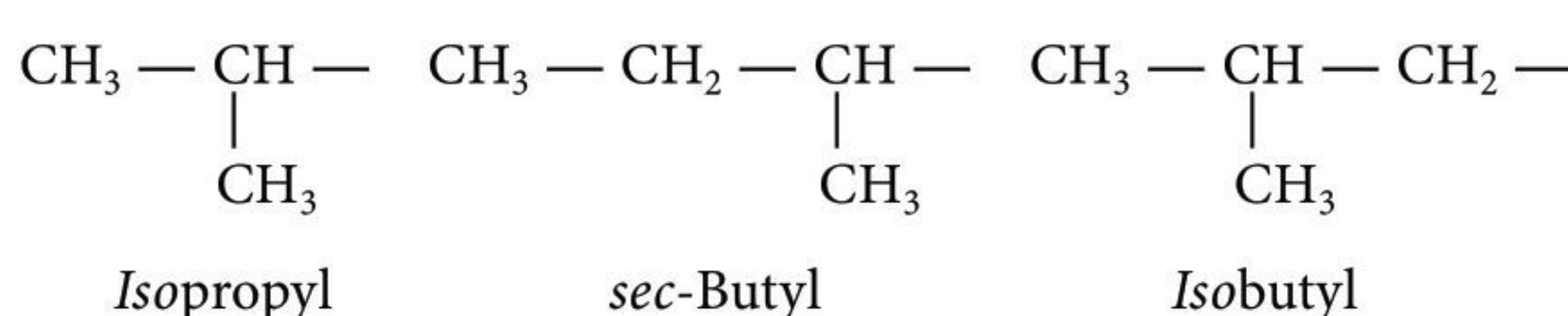
alkane - ane + yl → alkyl

$-\text{CH}_3$ methane + yl → methyl

$-\text{CH}_2\text{CH}_3$ ethane + yl → ethyl

$-\text{CH}_2\text{CH}_2\text{CH}_3$ propane + yl → propyl

- The alkyl groups can be branched also.



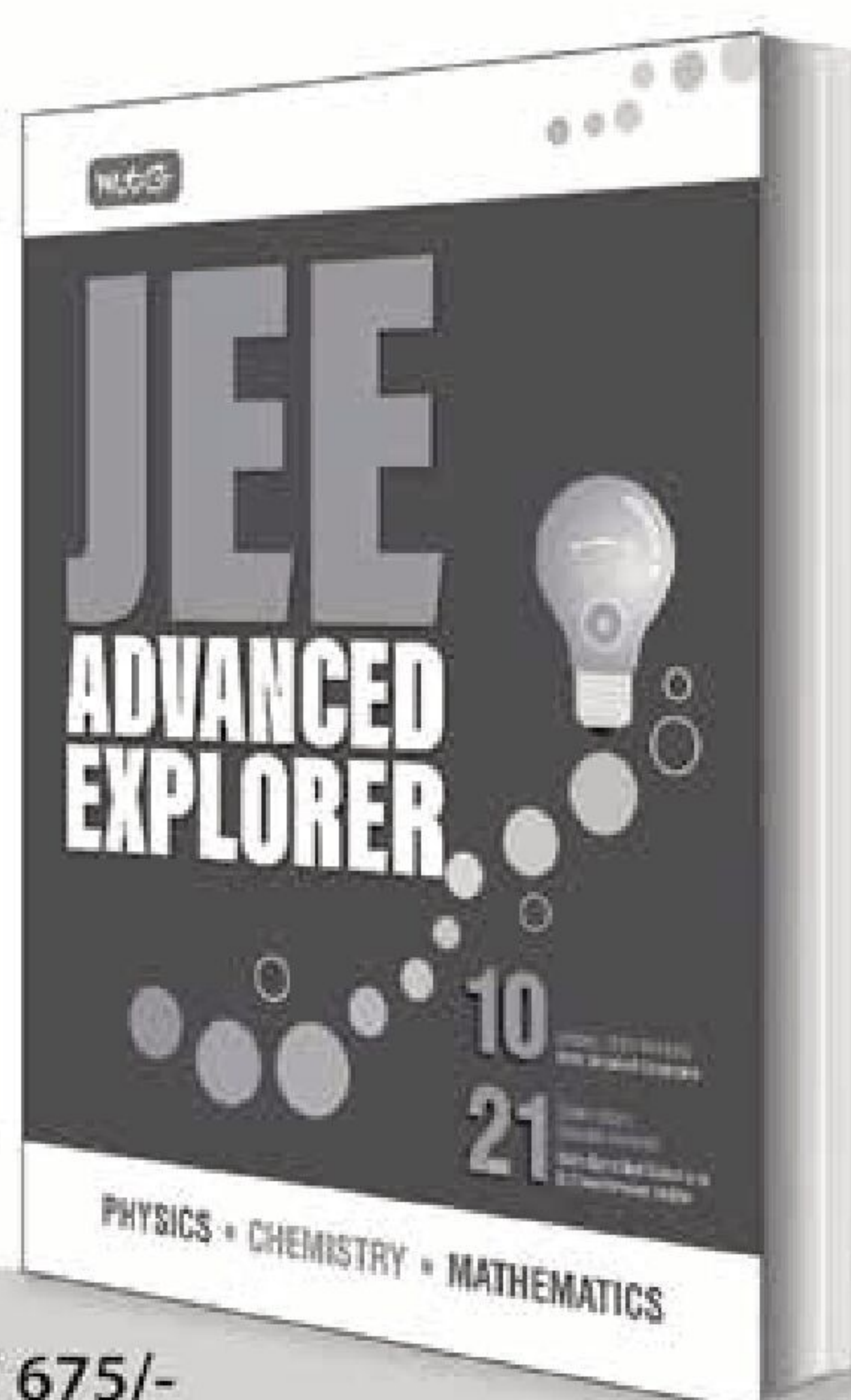
- **Longest chain rule :** The longest carbon chain in the molecule is identified.
- If there happens to be two chains of equal size, then that chain is selected which contains more number of side chains.

mtG

JEE

ADVANCED EXPLORER

21 years
(2001-2021)
Solved Papers
with detailed
Solutions &
chapterwise index



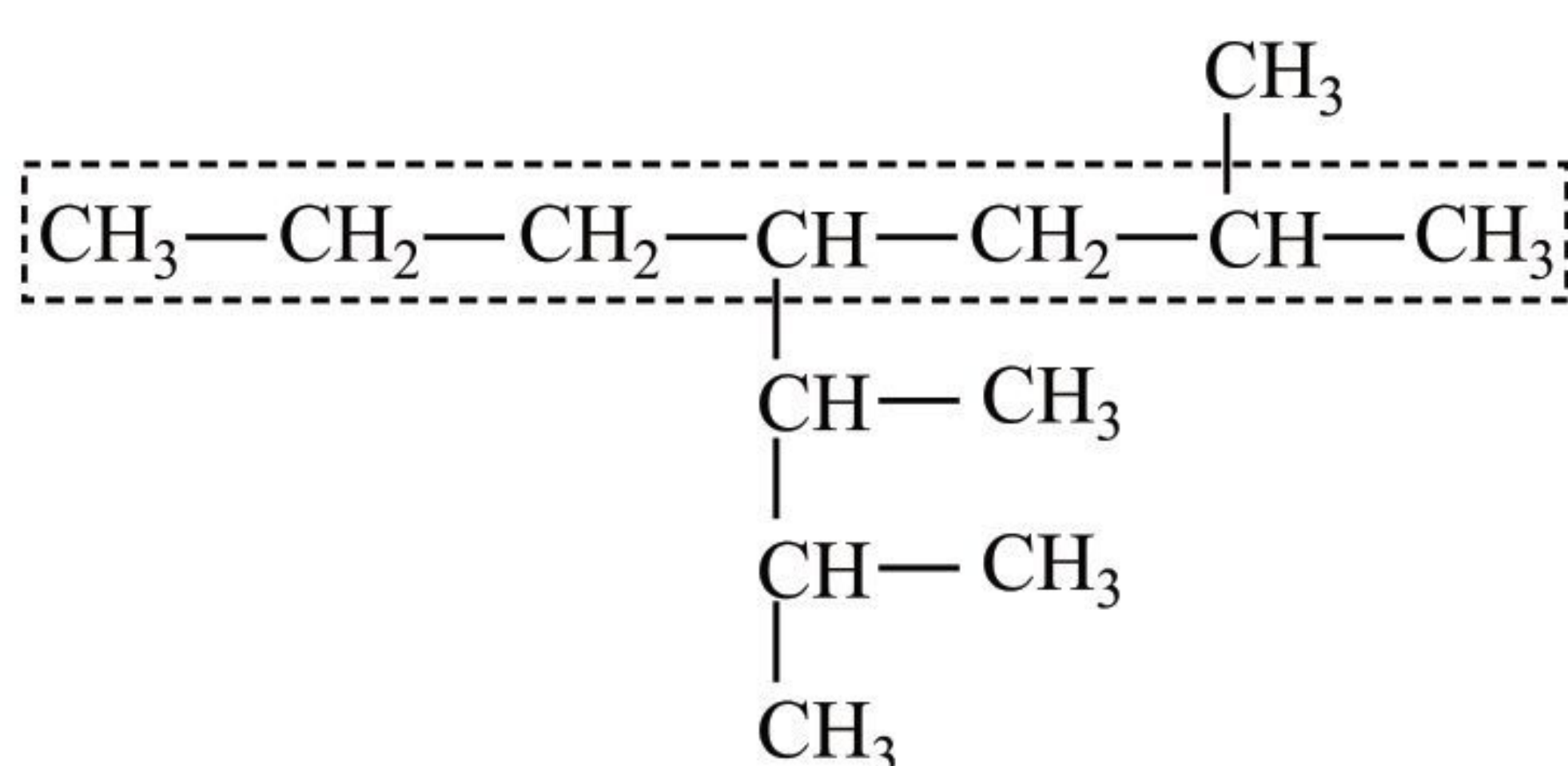
10 Model
Test Papers
with detailed
Solutions

₹ 675/-

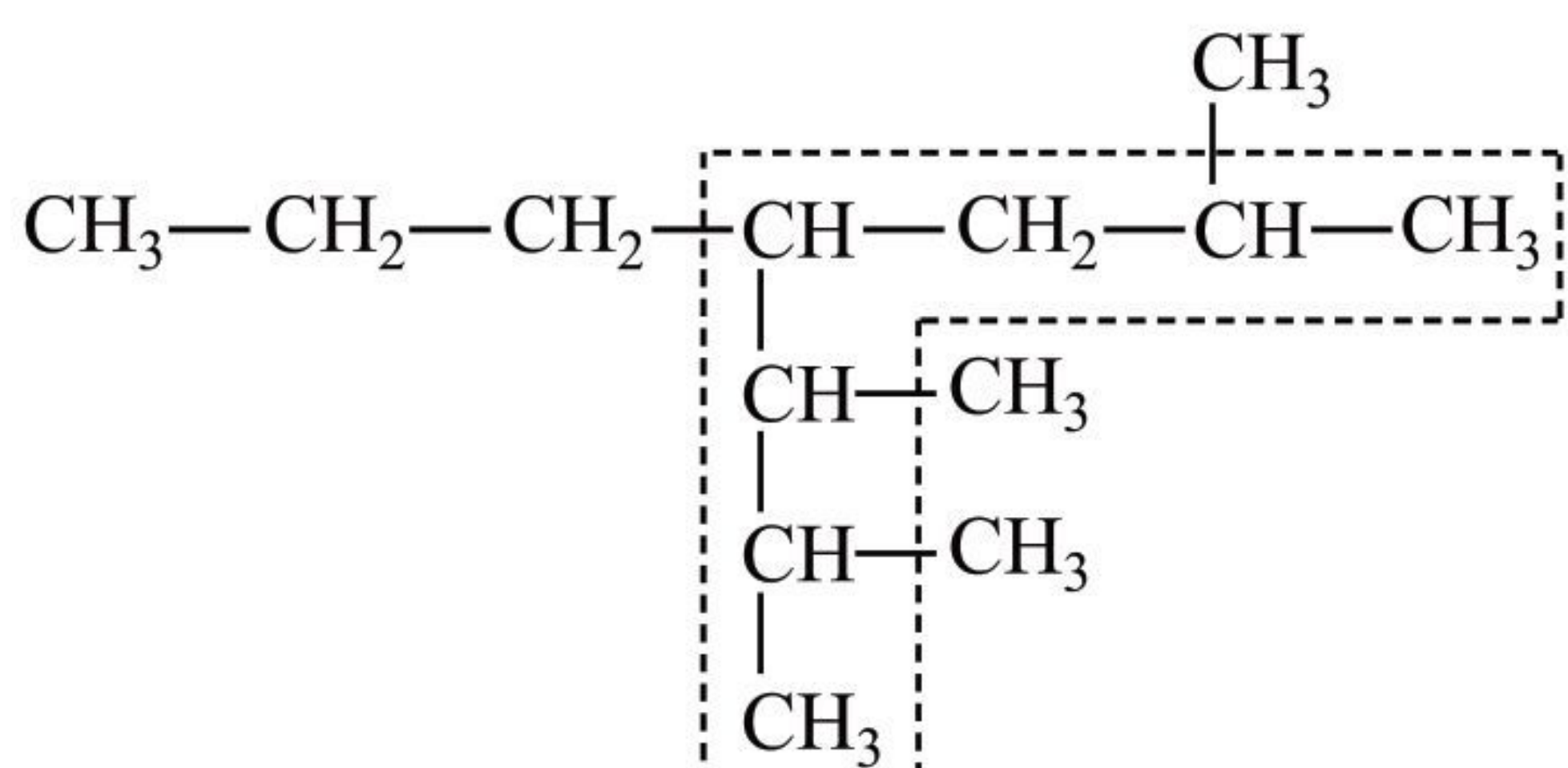


Available at all leading book shops throughout the country.
For more information or for help in placing your order:
Call 0124-4951200 or email: info@mtg.in

Visit
www.mtg.in
for latest offers
and to buy
online!



Longest chain of seven carbon atoms having two substituents only (not correct)

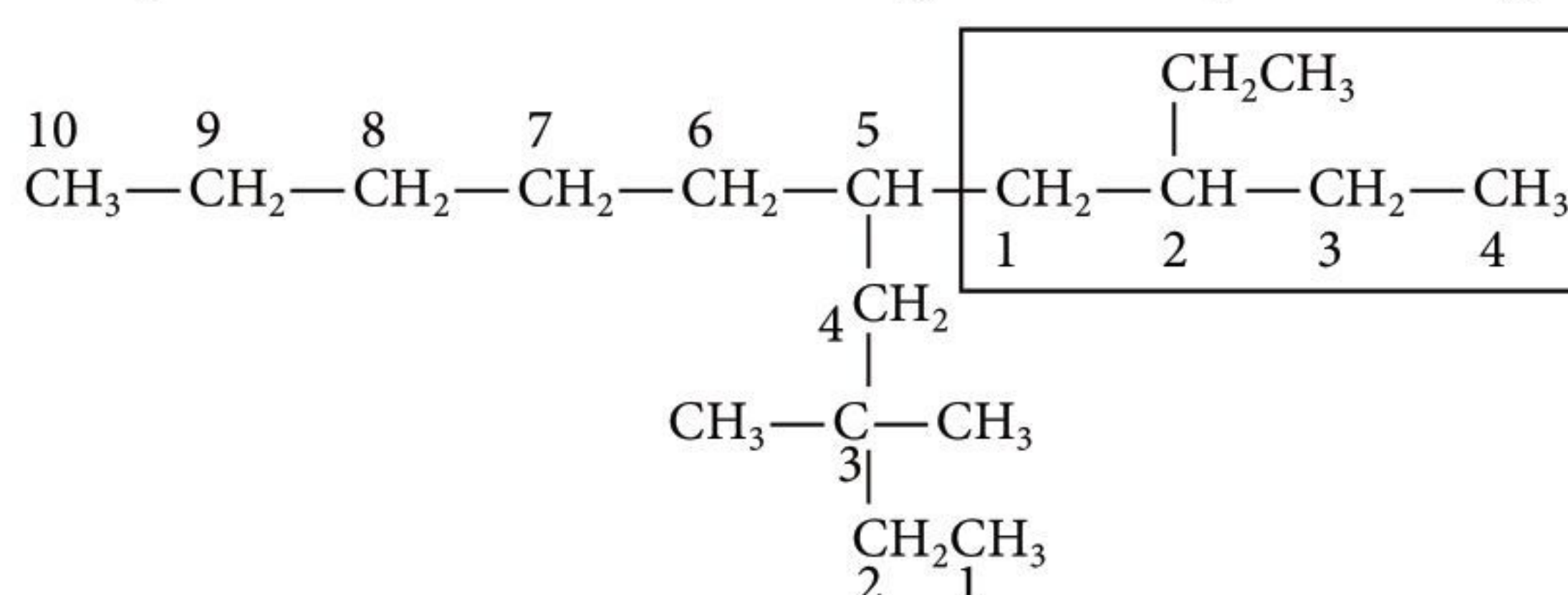


Longest chain of seven carbon atoms having four substituents (correct)

- **Lowest number rule** : The longest carbon chain is numbered as 1, 2, 3, 4, etc. starting from that end which gives the smallest possible number to the substituent.
- **Lowest sum rule** : In case of two or more substituents, numbering is done in such a way that the sum of the positional number of substituent or locant is the lowest.
- If there are different alkyl substituents attached to the parent chain, their names are written in the alphabetical order.
- If a substituent is present two or more times, then it is indicated by the prefix *di-*, *tri-*, *tetra-*, etc.
- If the two substituents are found in equivalent positions, the lower number is given to the one coming first in the alphabetical listing. *e.g.*,

$$\begin{array}{cccccccc} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ \text{CH}_3 - & \text{CH}_2 - & \text{CH} - & \text{CH}_2 - & \text{CH}_2 - & \text{CH} - & \text{CH}_2 - & \text{CH}_3 \\ & & | & & & | & & \\ & & \text{CH}_2\text{CH}_3 & & & \text{CH}_3 & & \end{array}$$

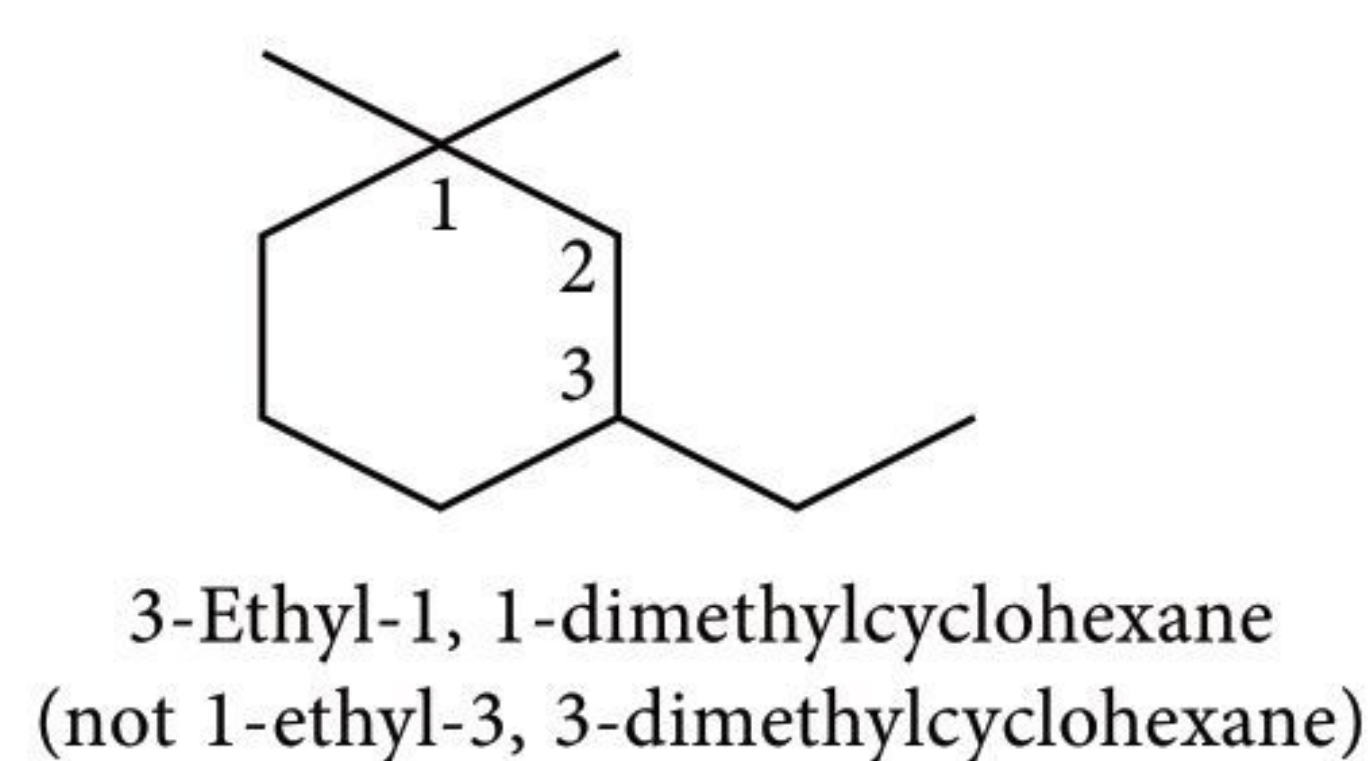
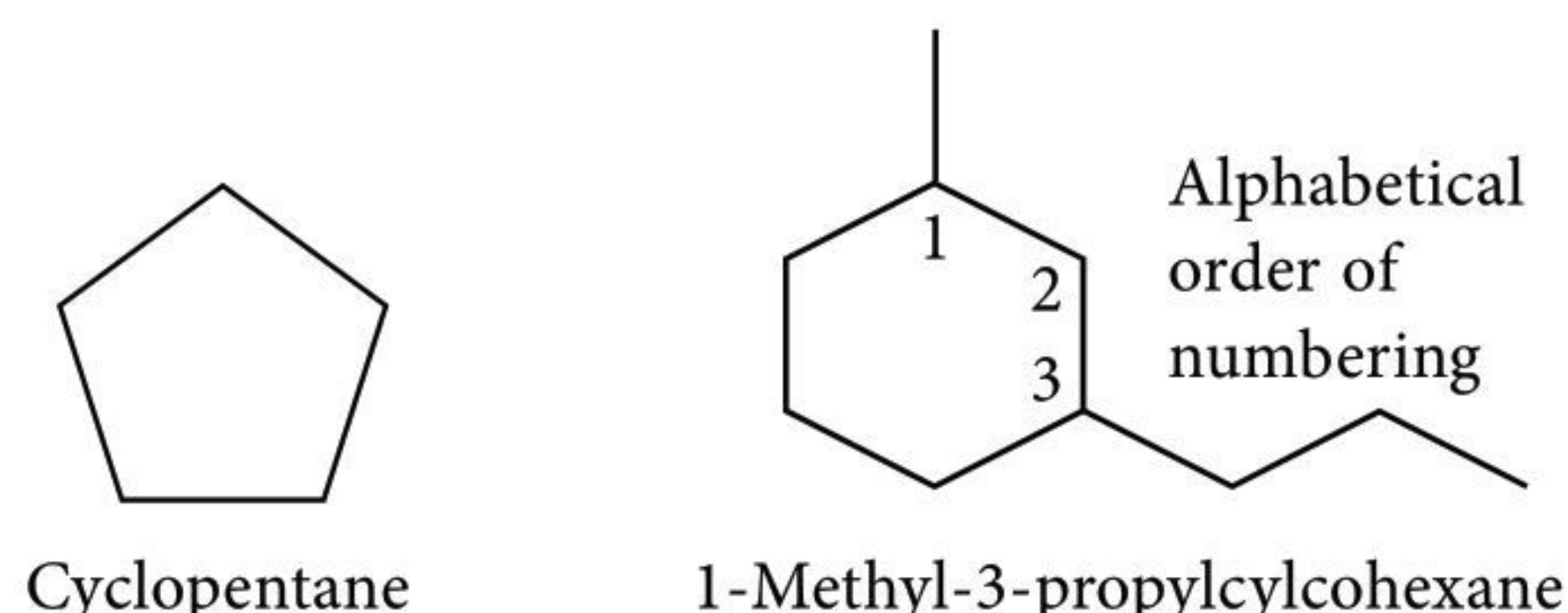
3-ethyl-6-methyloctane
- The carbon atom of the branch that is attached to the root alkane is numbered as 1. The name of such branched chain alkyl group is placed in parenthesis while naming the compound. *e.g.*,



5-(2-Ethylbutyl)-3, 3-dimethyldecane
[and not 5-(2, 2-dimethylbutyl)-3-ethyldecane]

- The use of *iso* and related common prefixes for naming alkyl groups is also allowed by the IUPAC nomenclature as long as these are not further substituted.

- **Cyclic compounds** : A saturated monocyclic compound is named by prefixing 'cyclo' to the corresponding straight chain alkane. If side chains are present, then the rules given above are applied. *e.g.*,



Nomenclature of Unsaturated Hydrocarbons

- **Longest chain rule** : The longest chain is so selected as to include maximum number of double or triple bonds, even if it is not the actual longest chain of carbon atoms.
- **Lowest number rule** : Lowest number is assigned to the first unsaturated carbon according to the lowest set of locants rule.
- If double and triple bonds are at the same position from either ends, lowest number is assigned to the double bond. *e.g.*,

$$\begin{array}{ccccccc} 5 & 4 & 3 & 2 & 1 & & \\ \text{CH} \equiv \text{C} - & \text{CH}_2 - & \text{CH} = & \text{CH}_2 & & & \\ 1 & 2 & 3 & 4 & 5 & & \end{array}$$

← Correct
← Wrong
- Organic compound containing multiple bond, side chain or substituents follow the order of preference as :
Double bond > Triple bond > Substituent/side chain

Your favourite MTG Books/Magazines available in PONDICHERY at

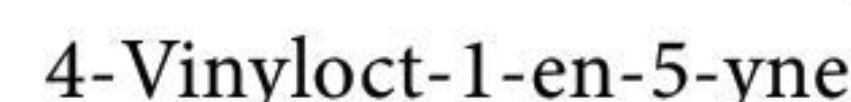
Siruvur Pakkam - Pondicherry Ph: 2338686; 9894034367, 9087734367

Sri Sivagami News Agency - Pondicherry Ph: 9443074953

Visit **"MTG IN YOUR CITY"** on www.mtg.in to locate nearest book seller OR write to info@mtg.in OR call

0124-6601200 for further assistance.

- $$\begin{aligned} &= \text{CH}_2 \text{ (methylene), } =\text{CH}-\text{CH}_3 \text{ (ethylidene),} \\ &-\text{CH}=\text{CH}_2 \text{ (vinyl or ethenyl),} \end{aligned}$$



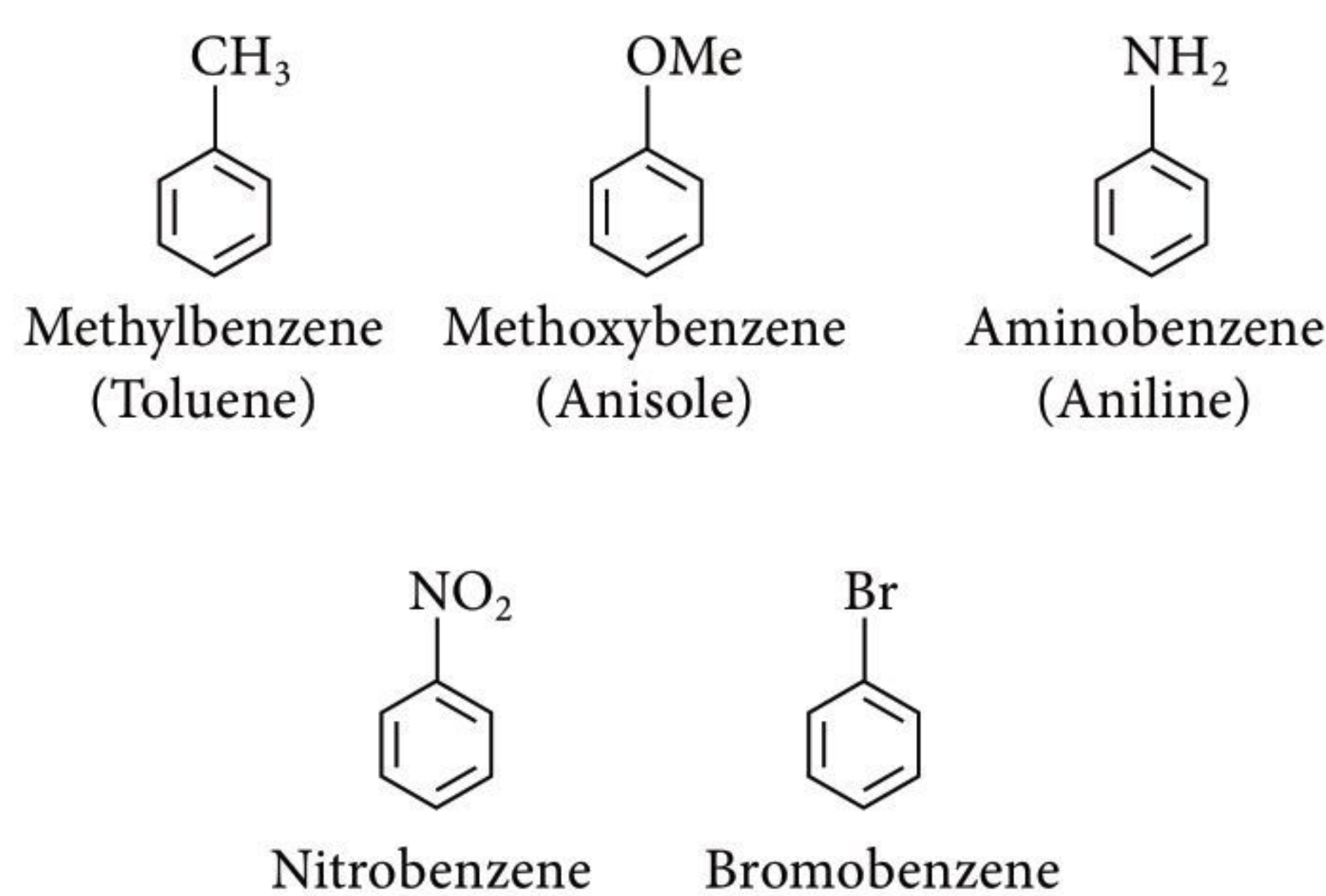
Nomenclature of Organic Compounds Having Functional Group(s)

	Functional Groups	Structure	Prefix	Suffix
1.	Carboxylic acid	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{OH} \end{array}$	Carboxy	- oic acid
2.	Acid amide	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{NH}_2 \end{array}$	Carbamoyl	- amide
3.	Acyl halide	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{X} \end{array}$	Halocarbonyl	- oyl chloride
4.	Alcohol	- OH	Hydroxy	- ol
5.	Aldehyde	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{H} \end{array}$	Formyl or aldo	- al
6.	Ketone	$\begin{array}{c} \text{O} \\ \\ -\text{C}- \end{array}$	Keto or oxo	- one
7.	Ester	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{O}-\text{R} \end{array}$	Alkoxycarbonyl	Alkyl....oate
8.	Ether	- O - R	Alkoxy	-
9.	Oxirane	$\begin{array}{c} \text{C}-\text{C}- \\ \diagup \quad \diagdown \\ \text{O} \end{array}$	Epoxy	-
10.	Halide	- X	Halo	-
11.	Amine	- NH ₂	Amino	amine
12.	Cyanide	- C≡ N	Cyano	nitrile
13.	Isocyanide	- NC	Isocyano	isonitrile
14.	Nitro derivative	- NO ₂	Nitro	-
15.	Nitroso derivative	- NO	Nitroso	-
16.	Azo group	- N=N -	Azo	-
17.	Sulphonic derivative	- SO ₃ H	Sulpho	Sulphonic acid
18.	Thio alcohol	- SH	Mercapto	thiol
19.	Double bond	C=C	-	ene
20.	Triple bond	C≡ C	-	yne

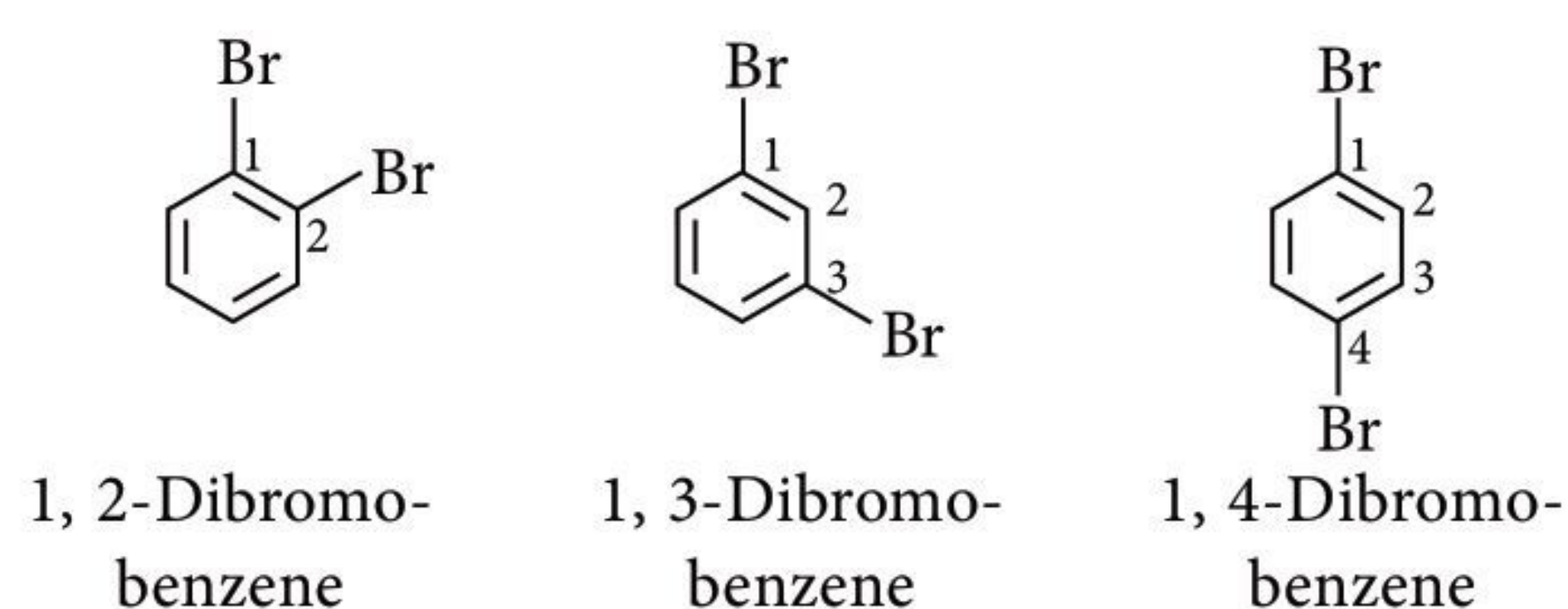
- ❑ **Longest chain rule :** Longest chain of carbon atoms containing the functional group is identified.
- ❑ **Lowest number rule :** Lowest number is assigned to the carbon atom containing the functional group.
- ❑ In IUPAC system, one of the functional groups is chosen as the principal functional group and the remaining functional groups are treated as substituents and indicated by prefixes. Order of preference is :
 $-\text{COOH} > -\text{SO}_3\text{H} > -\text{COOR} > -\text{COX} >$
 $-\text{CONH}_2 > -\text{CN} > -\text{NC} > -\text{CHO} > >\text{C}=\text{O}$
 $> -\text{OH} > -\text{SH} > -\text{NH}_2 > -\text{OR} > >\text{C}=\text{C}<$
 $> -\text{C}\equiv\text{C}-$
- ❑ The parent chain is so selected that it includes the maximum number of functional groups including the principal group.

Nomenclature of Substituted Benzene Compounds

- ❑ For IUPAC nomenclature of substituted benzene compounds, the substituent is placed as prefix to the word benzene as shown in the following examples.

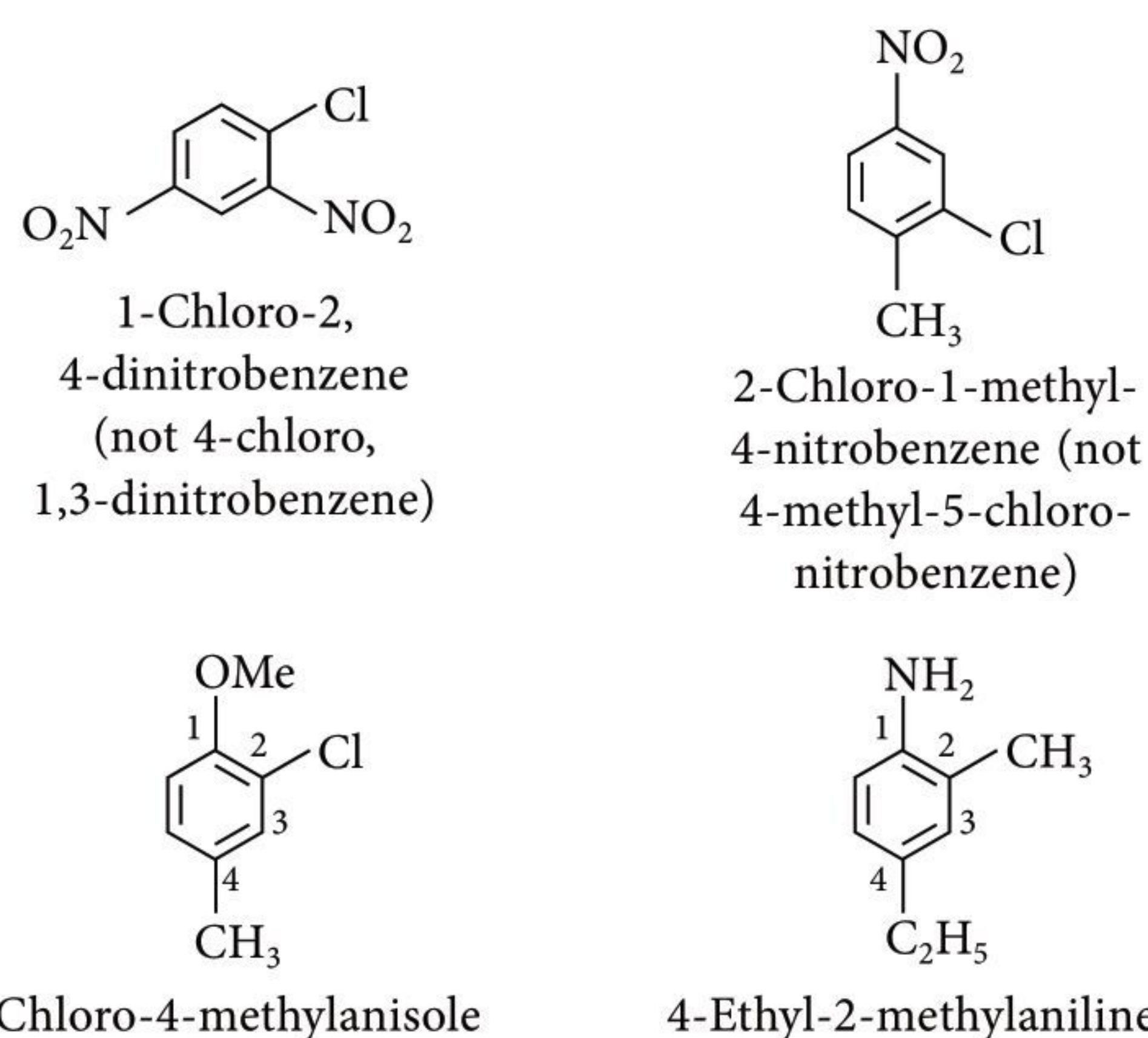


- ❑ If benzene ring is disubstituted, the position of substituents is defined by numbering the carbon atoms of the ring such that the substituents are located at the lowest numbers possible.

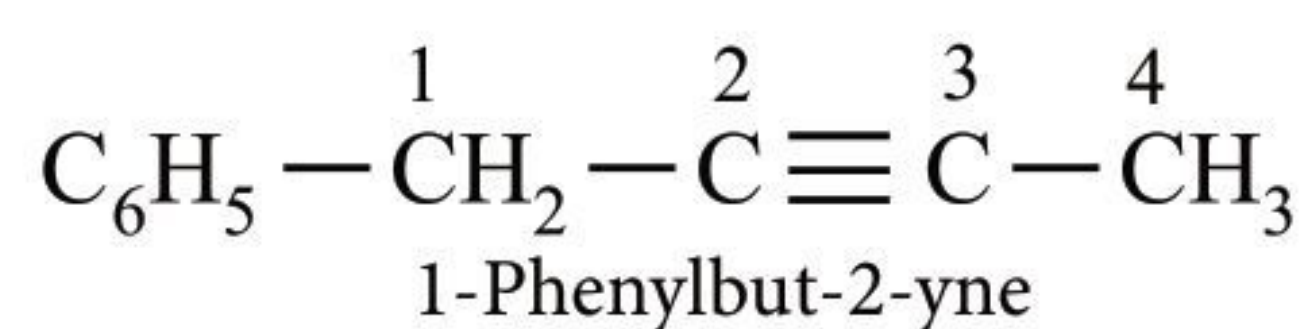
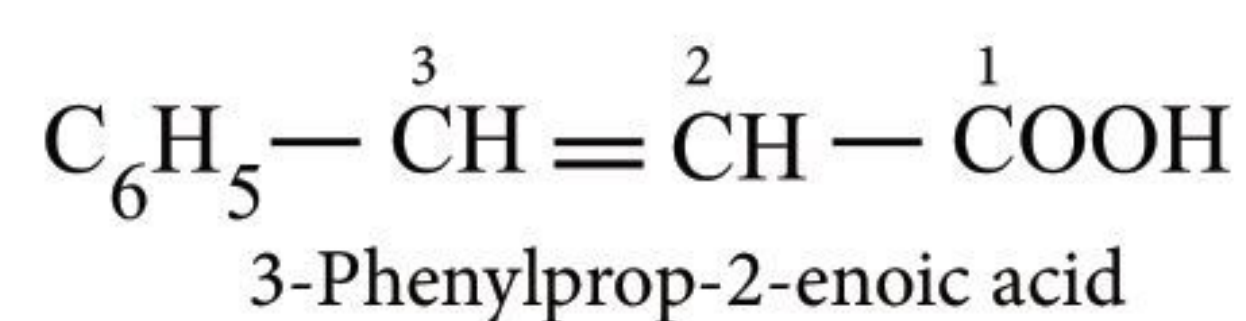
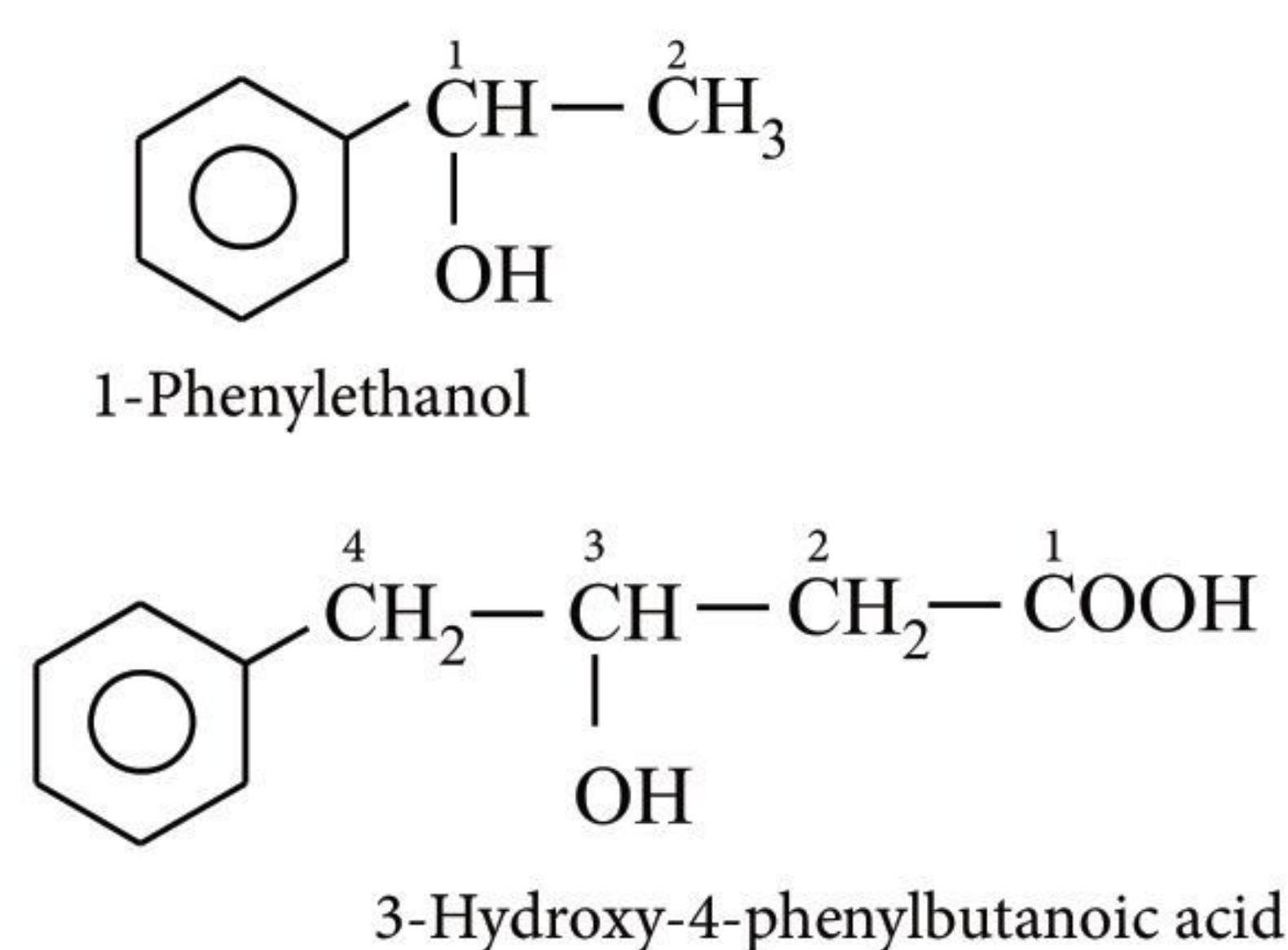


- ❑ In the trivial system of nomenclature, the terms *ortho* (*o*), *meta* (*m*) and *para* (*p*) are used as prefixes to indicate the relative positions 1, 2-; 1, 3- and 1, 4- respectively.

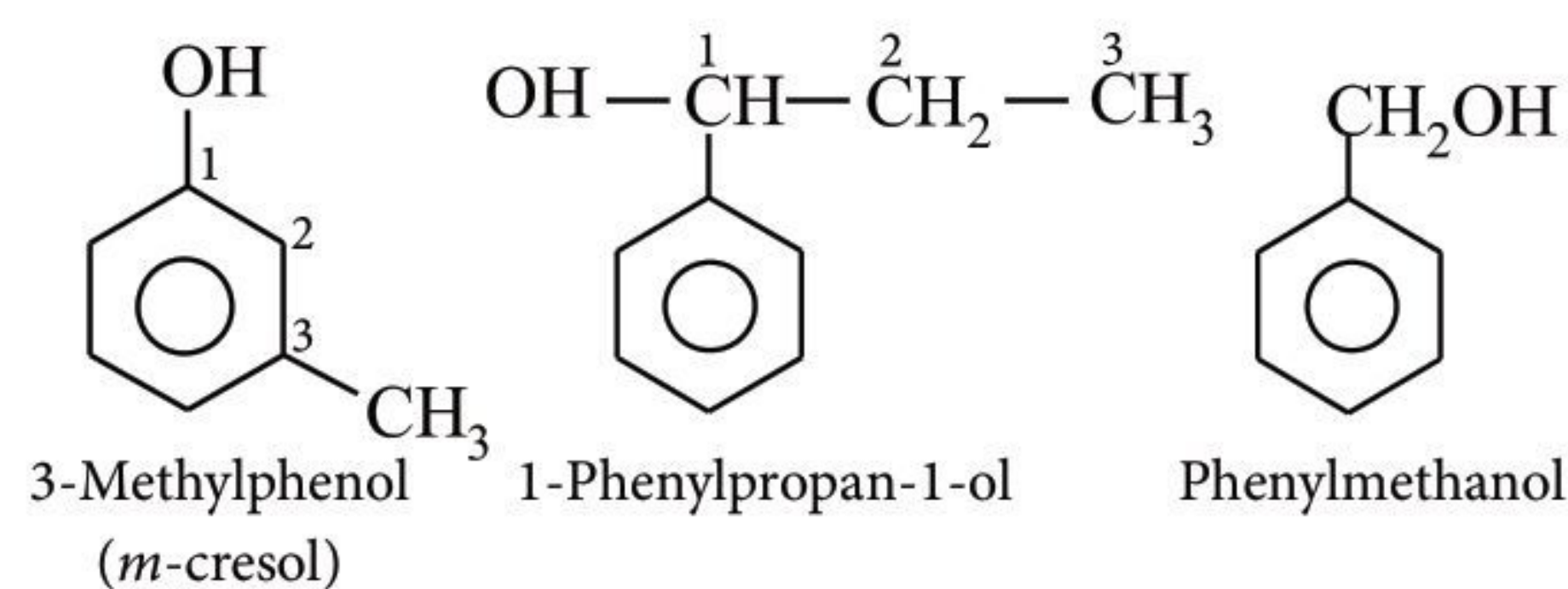
- ❑ For tri- or higher substituted benzene derivatives, these prefixes cannot be used and the compounds are named by identifying substituent positions on the ring by following the lowest locant rule. In some cases, common name of benzene derivatives is taken as the base compound. *e.g.*,



- ❑ If side chain contains a functional group, then these are said to be phenyl derivatives of the corresponding aliphatic compounds.



- ❑ The nuclear hydroxy derivatives are called phenols while the side chain substituted hydroxy derivatives are called aromatic alcohols.



mtG

For Enquiries
0124-6601200

Find all your
QUESTIONS here,
before getting them
in your exam.

By not studying
MORE but
ACCURATE...



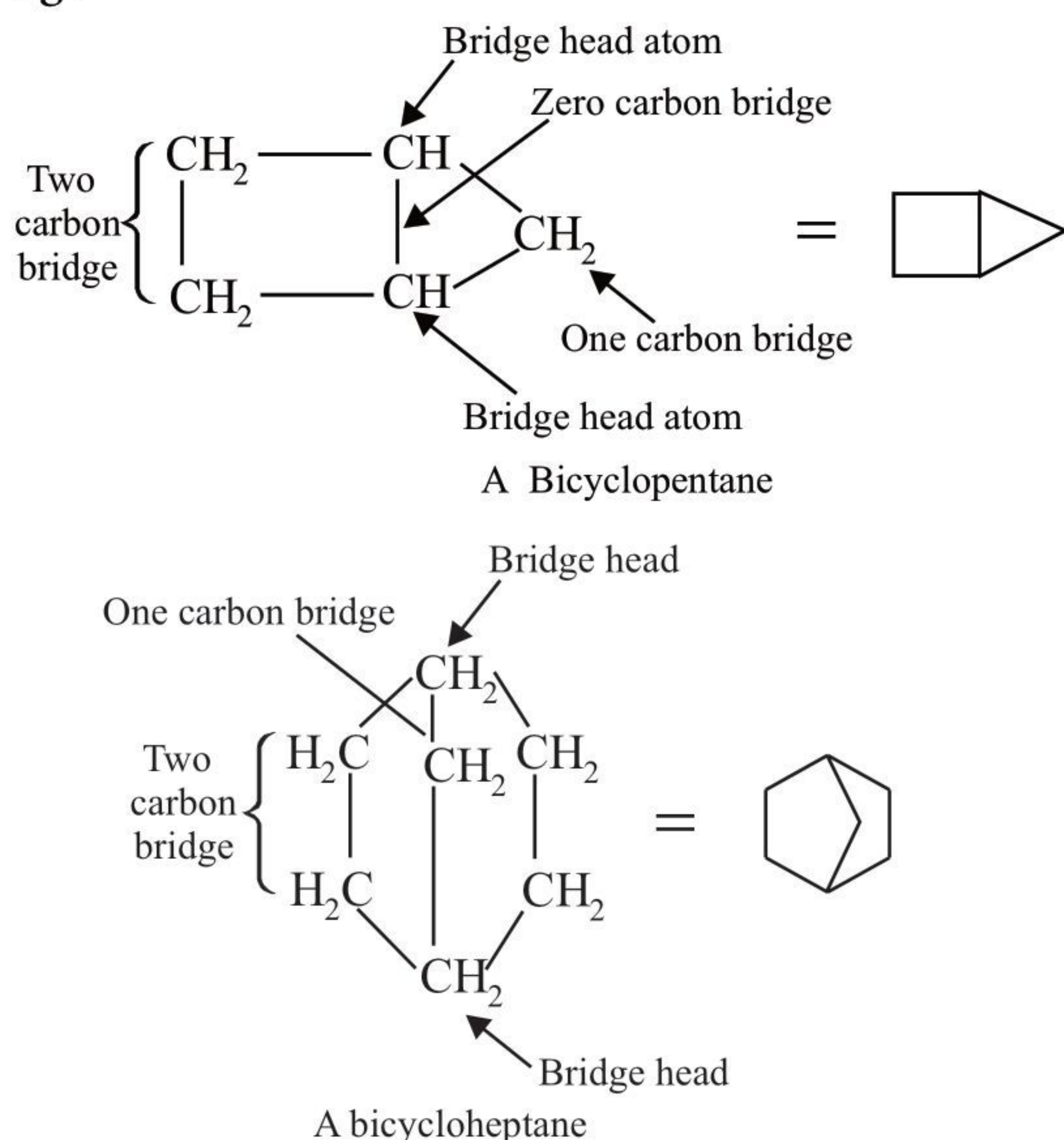
Our Books



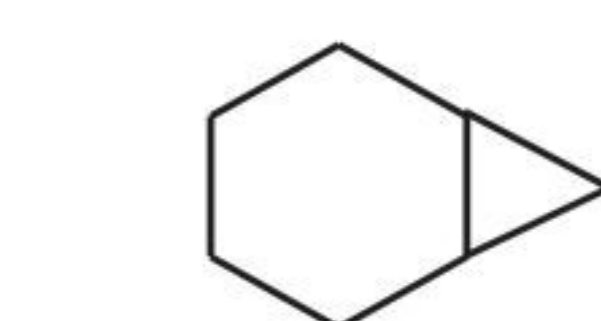
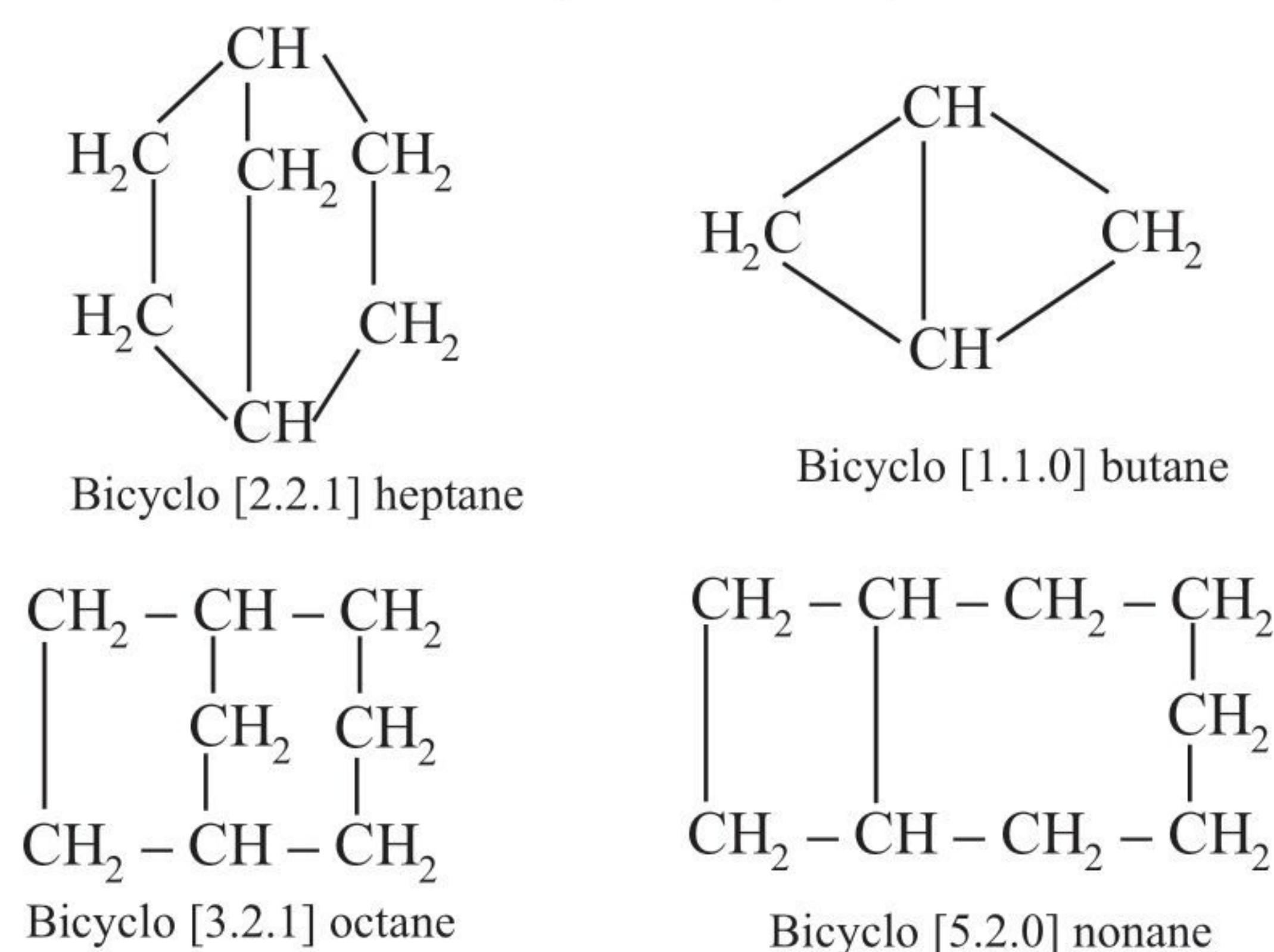
JEE 2022 exams are nearing and all the students must be in the stage of preparation with full dedication and hard work. But have you put your knowledge to test? With our 40 years of experience, we would suggest you to put yourself through MTG's JEE Champion Series so that you can be sure about your level of preparation and find your core strengths and capabilities. The best part is you study at a pace you're comfortable with. Because it's all chapters, topicwise.

Nomenclature of Bicyclic Compounds

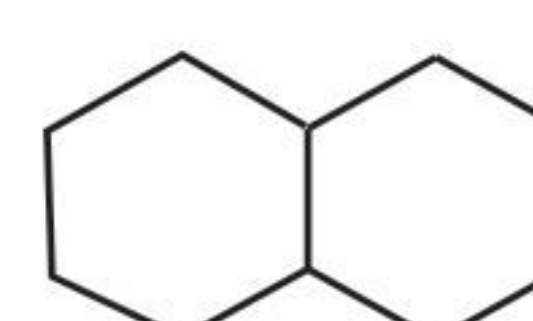
- There are some compounds which contain 2 fused aliphatic rings of hydrocarbons. These compounds are called bicyclic compounds. The carbon atoms common to both the rings are called bridge head atoms, and each bond or chain of C-atoms connecting the bridge head atoms, is called a bridge. The bridge may contain 0, 1, 2, ..., etc. carbon atoms. *e.g.*



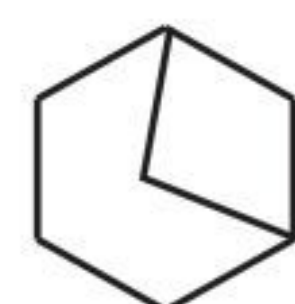
- Bicyclic compounds are named by adding prefix bicyclo to the name of hydrocarbon corresponding to total number of carbon atoms in two rings. In between the word bicyclo and alkane an expression in the square brackets is placed that represents the number of carbon atoms in each bridge connecting two bridge heads, in descending order separated from one another by full stop. *e.g.*



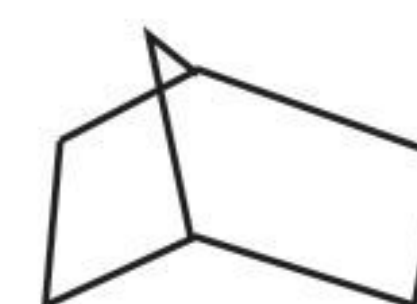
Bicyclo [4.1.0] heptane



Bicyclo [4.4.0] decane
(decahydronaphthalene)



Bicyclo [3.1.1] heptane



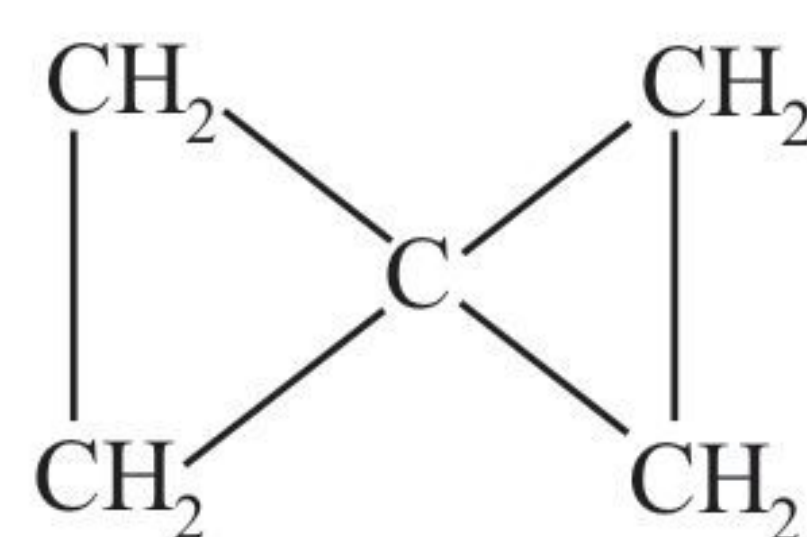
Bicyclo [2.2.1] heptane



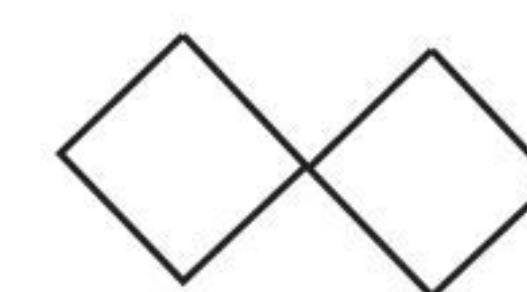
Bicyclo [2.2.2] octane

Nomenclature of Spiro Compounds or Spiranes

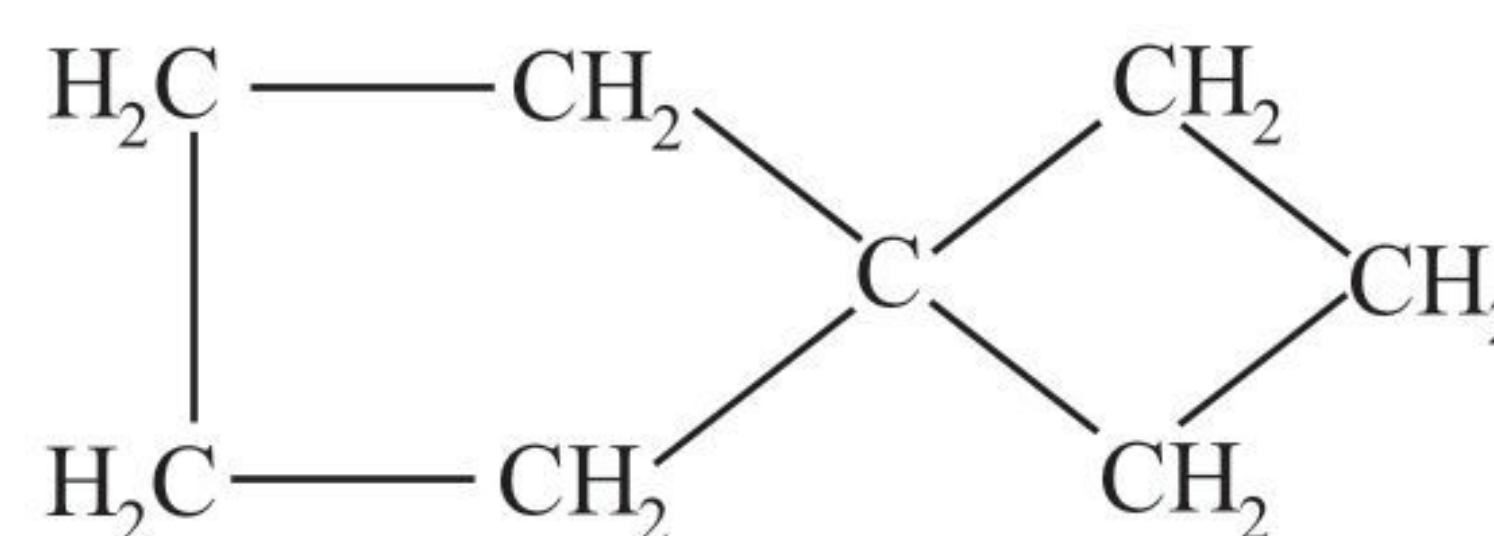
- Spiro compounds are compounds having one atom (usually a quaternary carbon) as the only common member of two rings.
- Spiro compounds are named by writing the prefix spiro followed by square brackets containing the number of carbon atoms in ascending order in each ring connected to the spiro atom followed by the name of hydrocarbon corresponding to the total number of carbon atoms in the two rings. *e.g.*



Spiro [2, 2] pentane

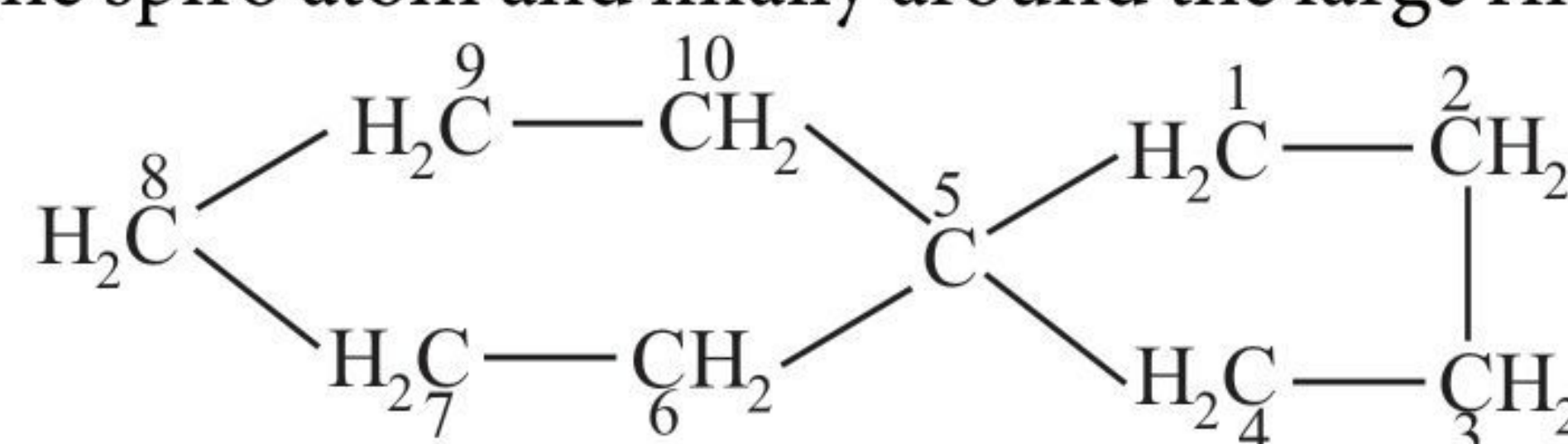


Spiro [3, 3] heptane

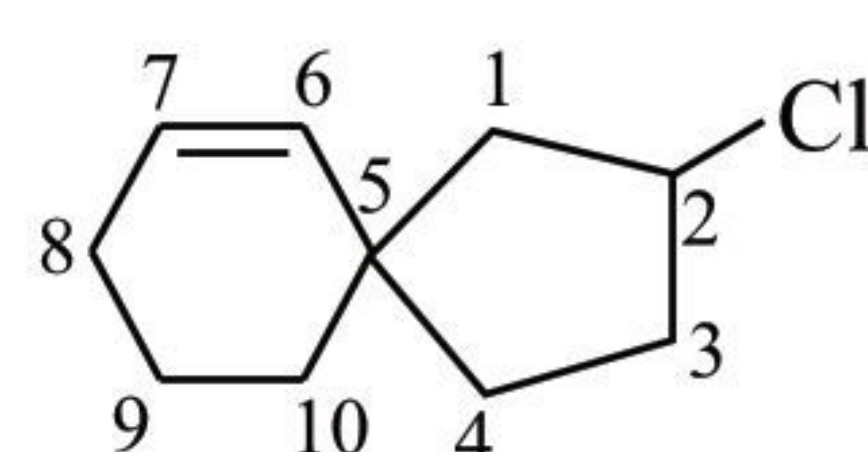


Spiro [3, 4] octane

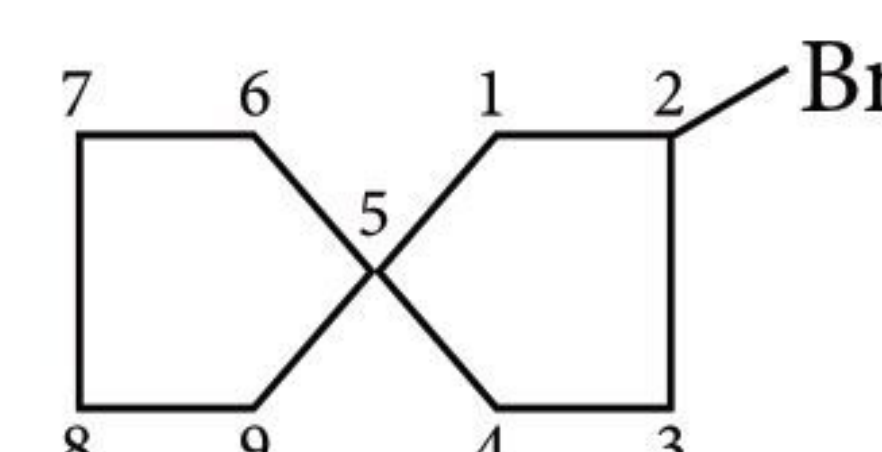
- If substitution is present, number the spiro compound beginning with the ring atom next to spiro atom and proceeding first around the smaller ring and then to the spiro atom and finally around the large ring. *e.g.*



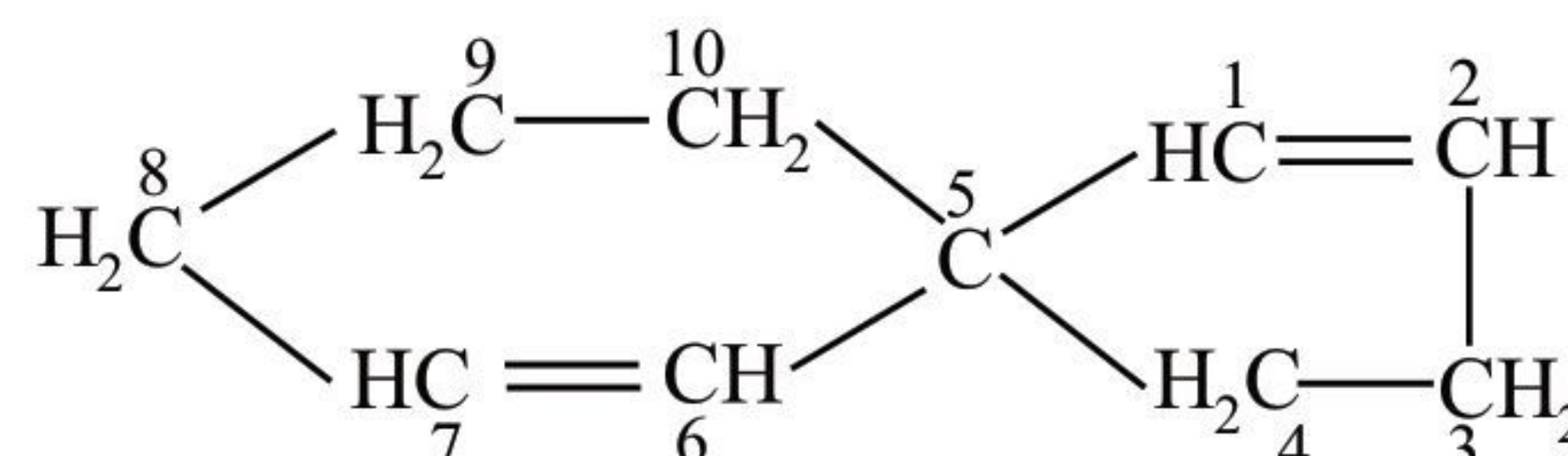
Spiro [4, 5] decane



2-Chlorospiro [4, 5] dec-6-ene



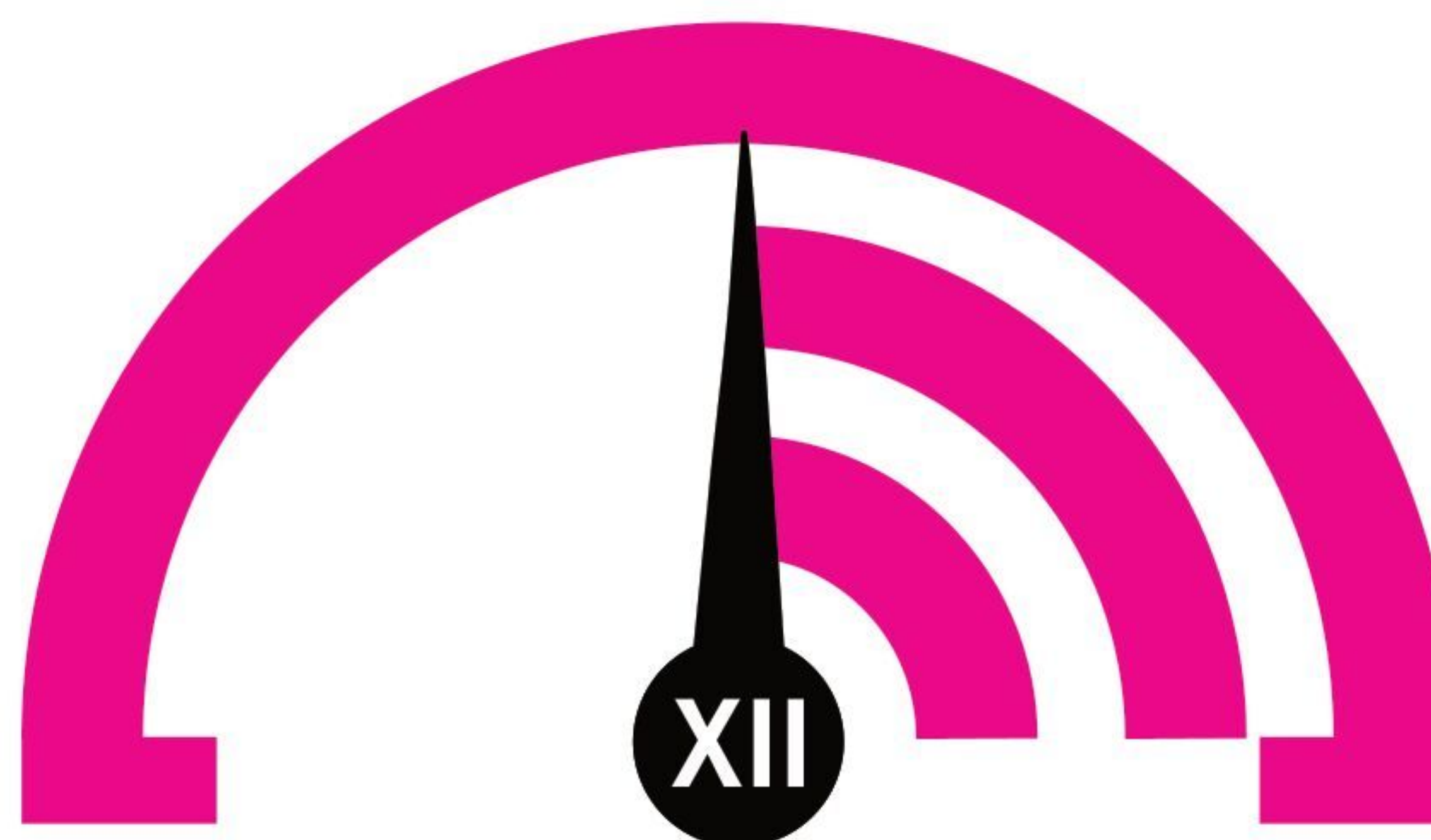
2-Bromospiro [4,4] nonane



Spiro [4, 5] deca-1,6-diene



MONTHLY TEST DRIVE



This specially designed column enables students to self analyse their extent of understanding of specified chapters. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

Total Marks : 120 Metallurgy | The *p*-Block Elements (Group 15 to 18) Time Taken : 60 Min.

NEET

Only One Option Correct Type

- In the cyanide leaching process of silver from argentite ore, the oxidising and reducing agent used are
(a) O_2 and CO respectively
(b) O_2 and Zn dust respectively
(c) HNO_3 and Zn dust respectively
(d) HNO_3 and CO respectively.
- A hydride (X) of a group-15 element is distinctly basic and has unexpectedly high boiling point. It reacts with NaOCl to give another hydride (Y) which is a strong reducing agent and is used in organic analysis. X and Y are
(a) PH_3 , P_2H_4 (b) NH_3 , N_2H_4
(c) AsH_3 , As_2H_4 (d) NH_3 , NH_2Cl
- In alkaline solution $HXeO_4^-$ disproportionates to
(a) XeO_6^{4-} and Xe (b) XeO_4^{2-} and XeO_3
(c) XeO_3 and Xe (d) XeO_6^{4-} and XeO_3
- Native silver metal forms a water soluble complex with a dilute aqueous solution of NaCN in the presence of
(a) nitrogen (b) oxygen
(c) carbon dioxide (d) argon.
- Sulphur reacts with chlorine in 1 : 2 ratio and forms (X). (X) on hydrolysis gives a sulphur compound (Y). What is the hybridized state of central atom in the anion of (Y)?
(a) sp (b) sp^3 (c) sp^2 (d) sp^3d
- Which of the following are main requirements for vapour phase refining?
(i) Metal should form a volatile compound with the reagent.
(ii) The volatile compound should be easily decomposable to give back pure metal.
(iii) Metal should be very reactive and form a stable compound with the reagent.
(a) (i), (ii) and (iii) (b) Only (i) and (ii)
(c) Only (ii) and (iii) (d) Only (i) and (iii)
- From the Ellingham graphs on carbon, which of the following statements is false?
(a) CO_2 is more stable than CO at less than 983 K.
(b) CO reduces Fe_2O_3 to Fe at less than 983 K.
(c) CO is less stable than CO_2 at more than 983 K.
(d) CO reduces Fe_2O_3 to Fe in the reduction zone of blast furnace.
- The correct statement about ICl_5 and ICl_4^- is
(a) both are isostructural
(b) ICl_5 is square pyramidal and ICl_4^- is square planar
(c) ICl_5 is trigonal bipyramidal and ICl_4^- is tetrahedral
(d) ICl_5 is square pyramidal and ICl_4^- is tetrahedral.



BUY ONLINE

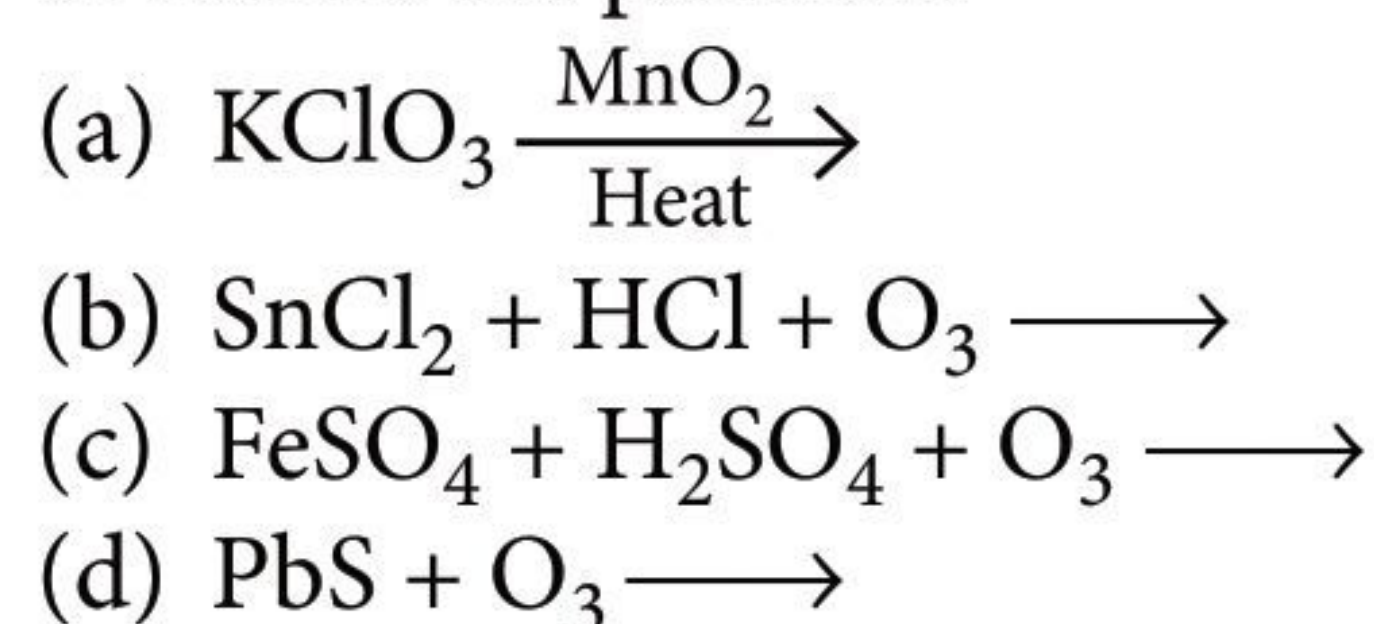
Now you can buy

MTG Books & Magazines

Log on to : www.mtg.in

9. If phosphorous acid is allowed to react with sufficient quantity of KOH, the product obtained is
 (a) K_3PO_3 (b) KH_2PO_3
 (c) K_2HPO_3 (d) $KHPO_3$

10. In which of the following reactions O_2 is not formed as one of the product?



11. Siderite and sphalerite are respectively the ores of the metals

- (a) Al and Zn (b) Fe and Cu
 (c) Cu and Zn (d) Fe and Zn.

12. Tempering of steel

- (a) is heating the steel to appropriate temperature and then cooling it rapidly
 (b) increases mechanical strength
 (c) changes ratio of carbon in cementite
 (d) all of the above.

Assertion & Reason Type

Directions : In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
 (b) If both assertion and reason are true but reason is not the correct explanation of assertion.
 (c) If assertion is true but reason is false.
 (d) If both assertion and reason are false.

13. **Assertion :** $SeCl_4$ does not have a tetrahedral structure.

Reason : Se in $SeCl_4$ has two lone pairs.

14. **Assertion :** HOCl is a stronger acid than HOBr.

Reason : More the electronegativity of the halogen, stronger is the acid.

15. **Assertion :** Al cannot reduce MgO below 1500°C while Al can reduce MgO above 1500°C .

Reason : Mg is a liquid at less than 1500°C and gas at above 1500°C .

JEE MAIN / JEE ADVANCED

16. Which of the following statements is correct according to the basic concepts of thermodynamics which govern the feasibility of a metallurgical process?

- (a) When the value of ΔG is positive for the equation $\Delta G = \Delta H - T\Delta S$, the reaction will proceed.

- (b) If reactants and products of two reactions are put together and net ΔG is -ve, the overall reaction will occur.

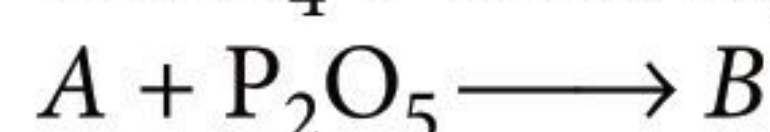
- (c) On increasing the temperature, the value of ΔG becomes +ve.

- (d) Feasibility of thermal oxidation of an ore can be established by Ellingham diagram in which a straight line shows that the reduction reaction will proceed.

17. N_2 does not show property of catenation because

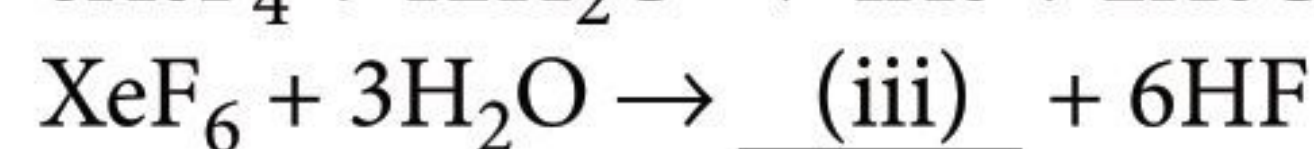
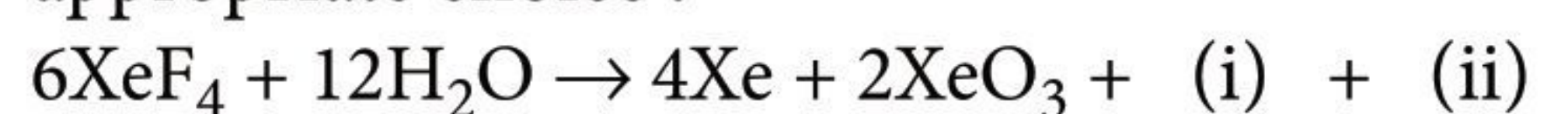
- (a) it has no 'd' orbitals in the valence shell
 (b) inter-electronic repulsion between non-bonding electrons is greater
 (c) $N \equiv N$ has high bond enthalpy
 (d) nitrogen has very high ionisation enthalpy.

18. The oxidation number of chlorine in the final product B in the following sequence of reaction is



- (a) +3 (b) +5
 (c) +7 (d) -1

19. Complete the following reactions by filling the appropriate choice :



- | (i) | (ii) | (iii) |
|------------|---------|-----------|
| (a) F_2 | H_2O | $XeOF_4$ |
| (b) $24HF$ | $3O_2$ | XeO_3 |
| (c) $12HF$ | $2H_2O$ | XeO |
| (d) HF | H_2O | Xe_2O_3 |

More than One Option

20. Which of the following statements are true?

- (a) Rhombic sulphur transforms to monoclinic sulphur when heated above 369 K .
 (b) Bond energy of F_2 is less than Cl_2 .
 (c) PCl_5 does not exist but NCl_5 exists.
 (d) Elements of 15th group show only +3 and +5 oxidation states.

21. Van Arkel of refining zirconium involves

- (a) removing all oxygen
 (b) removing all nitrogen
 (c) removing silica impurity
 (d) removing hydrogen impurity.

22. White phosphorus (P_4) has

- (a) six P—P single bonds
 (b) four P—P single bonds
 (c) four lone pairs of electrons
 (d) PPP angle of 60° .

23. During the production of iron and steel,
- the oxide ore is primarily reduced to iron by solid coke according to the reaction,

$$2\text{Fe}_2\text{O}_3 + 3\text{C} \longrightarrow 4\text{Fe} + 3\text{CO}_2$$
 - the oxide ore is reduced by carbon monoxide according to the reaction

$$\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$$
 - major silica impurities are removed as calcium silicate slag by addition of a fluxing agent limestone
 - the silicate slag is used in manufacturing cement.

Integer / Numerical Value Type

24. Total number of oxides which are colourless in the given list of oxides is _____.
 $\text{NO}, \text{N}_2\text{O}, \text{N}_2\text{O}_3, \text{N}_2\text{O}_4, \text{N}_2\text{O}_5$
25. Among the following metals, how many metals are extracted by self-reduction method from their respective ores?
 $\text{Hg}, \text{Zn}, \text{Al}, \text{Mg}, \text{Pb}, \text{Fe}, \text{Sn}, \text{Cu}$
26. Oxyacids of sulphur are listed below. The number of oxyacids in which sulphur is present in +6 oxidation state is _____.
 $\text{H}_2\text{SO}_3, \text{H}_2\text{SO}_4, \text{H}_2\text{S}_2\text{O}_4, \text{H}_2\text{S}_2\text{O}_7, \text{H}_2\text{S}_2\text{O}_6, \text{H}_2\text{SO}_5, \text{H}_2\text{S}_2\text{O}_8$

Comprehension Type

The heating process for the extraction of elements is quite old but highly acceptable method for the extraction of element. Because in this process the element produced is in the highly pure state. Mostly As, Sb, Ni, Zr, B, etc are prepared by this principle. A number of metal sulphides are roasted first in air to partially convert them to the oxide, and then further roasted in the absence of air, causing self reduction.

27. Mark the correct statement.
- Calamine and siderite are carbonates.
 - Argentite and cuprite are oxides.
 - Zinc blende and pyrites are halides.
 - Malachite and siderites are ores of mercury.

28. Select the incorrect statement.
- In the decomposition of an oxide into metal, entropy increases.
 - To make ΔG negative, $|T\Delta S| > |\Delta H|$.
 - Ellingham diagram represents change in free energy with temperature.
 - Reduction of an oxide with aluminium is called van Arkel process.

Matrix Match Type

29. Match the entries listed in Column I with appropriate entries listed in Column II.

Column I (Name of ore)		Column II (Metal)	
(A) Malachite		(P) Zn	
(B) Calamine		(Q) Al	
(C) Galena		(R) Cu	
(D) Cryollite		(S) Pb	
A	B	C	D
(a) R	P	S	Q
(b) P	Q	R	S
(c) P	R	S	Q
(d) R	S	Q	P

30. Match the processes given in Column I with the respective catalysts listed in Column II and select the correct answer using the codes given below the lists :

Column I		Column II	
(P) Deacon's process		(1) Pt/Rh gauge	
(Q) Contact process		(2) Fe	
(R) Haber's process		(3) CuCl_2	
(S) Ostwald process		(4) V_2O_5	
P	Q	R	S
(a) 3	4	2	1
(b) 1	4	3	2
(c) 4	3	2	1
(d) 3	4	1	2



Keys are published in this issue. Search now! 😊

SELF CHECK

No. of questions attempted
 No. of questions correct
 Marks scored in percentage

Check your score! If your score is

> 90%	EXCELLENT WORK !	You are well prepared to take the challenge of final exam.
90-75%	GOOD WORK !	You can score good in the final exam.
74-60%	SATISFACTORY !	You need to score more next time.
< 60%	NOT SATISFACTORY!	Revise thoroughly and strengthen your concepts.

mtg

Now, savings of up to
₹920* with MTG's
 magazine
 subscription plans!

**On cover price of ₹40/-*

Our new offers are here!

Pick the combo best suited for your needs. Fill-in the Subscription Form at the bottom and mail it to us today. If in a rush, log on to www.mtg.in now to subscribe online.

**For JEE
 (Main &
 Advanced),
 NEET and
 BOARDS**

About MTG's Magazines

Perfect for students who like to prepare at a steady pace, MTG's magazines (**Physics For You**, **Chemistry Today**, **Mathematics Today** & **Biology Today**) ensure you practice bit by bit, month by month, to build all-round command over key subjects. Did you know these magazines are the only source for solved test papers of all national and state level engineering and medical college entrance exams?



Over 1.2 Cr readers. Since 1982.

- Practice steadily, paced month by month, with very-similar & model test papers
- Self-assessment tests for you to evaluate your readiness and confidence for the big exams
- Content put together by a team comprising experts and members from MTG's well-experienced Editorial Board
- Stay up-to-date with important information such as examination dates, trends & changes in syllabi
- All-round skill enhancement – confidence-building exercises, new studying techniques, time management, even advice from past JEE/NEET/ AIIMS toppers
- Bonus: Exposure to competition at a global level, with questions from International Olympiads & Contests

Lifetime Subscription Plan for teachers, and special schemes and offers available for libraries and coaching institutes. SMS MTG to 8800255334 to learn more.

SUBSCRIPTION FORM

Confirm your choice by placing ☒ tick-marks in relevant boxes.

Plan 1: Individual magazines P, C, M, B	<input type="checkbox"/> Physics <input type="checkbox"/> Chemistry <input type="checkbox"/> Mathematics <input type="checkbox"/> Biology	27 months <input type="checkbox"/> ₹850 <i>(save ₹230)</i>	15 months <input type="checkbox"/> ₹500 <i>(save ₹100)</i>	9 months <input type="checkbox"/> ₹300 <i>(save ₹60)</i>
Plan 2: Combo of 3	<input type="checkbox"/> PCM <input type="checkbox"/> PCB	<input type="checkbox"/> ₹2500 <i>(save ₹740)</i>	<input type="checkbox"/> ₹1400 <i>(save ₹400)</i>	<input type="checkbox"/> ₹900 <i>(save ₹180)</i>
Plan 3: PCMB Combo		<input type="checkbox"/> ₹3400 <i>(save ₹920)</i>	<input type="checkbox"/> ₹1900 <i>(save ₹500)</i>	<input type="checkbox"/> ₹1200 <i>(save ₹240)</i>
Courier Charges <i>Add to your subscription amount for quicker & reliable delivery</i>		<input type="checkbox"/> ₹600	<input type="checkbox"/> ₹450	<input type="checkbox"/> ₹240

Recommended by (Optional)

Name of your teacher

Teacher's Mobile #

Note: Magazines are despatched by Book-Post on 4th of every month (each magazine separately).

Name: _____

Complete Postal Address: _____

Pin Code

Mobile #

Other Phone # 0

Email _____

Enclose Demand Draft favouring
MTG Learning Media (P) Ltd, payable at New Delhi.
 Mail this Subscription Form to Subscription Dept.,
MTG Learning Media (P) Ltd, Plot 99, Sector 44, Gurugram -122 003 (HR).

E-mail subscription@mtg.in. Visit www.mtg.in to subscribe online. Call (0)1800-10-38673 for more info.
 Get digital editions of MTG Magazines on <http://digital.mtg.in/>



The most comprehensive question bank books that you cannot afford to ignore



₹ 350



₹ 350



₹ 400

34 Years' NEET Chapterwise-Topicwise Solutions Physics, Chemistry & Biology contain not only Chapterwise-Topicwise questions that have appeared over the last 34 years in NEET, but also full solutions, that too by experts. Needless to say, these question banks are essential for any student to compete successfully in NEET.

HIGHLIGHTS:

- Chapterwise-Topicwise questions of last 34 years' (2021-1988) of NEET/AIPMT
- Chapterwise-Topicwise segregation of questions to help you assess the level of effort required to succeed
- An unmatched question bank series with close to 1,000 pages having detailed solutions by experts



Scan now with your smartphone or tablet*



Available at all leading book shops throughout India.
For more information or for help in placing your order:
Call 0124-6601200 or email info@mtg.in

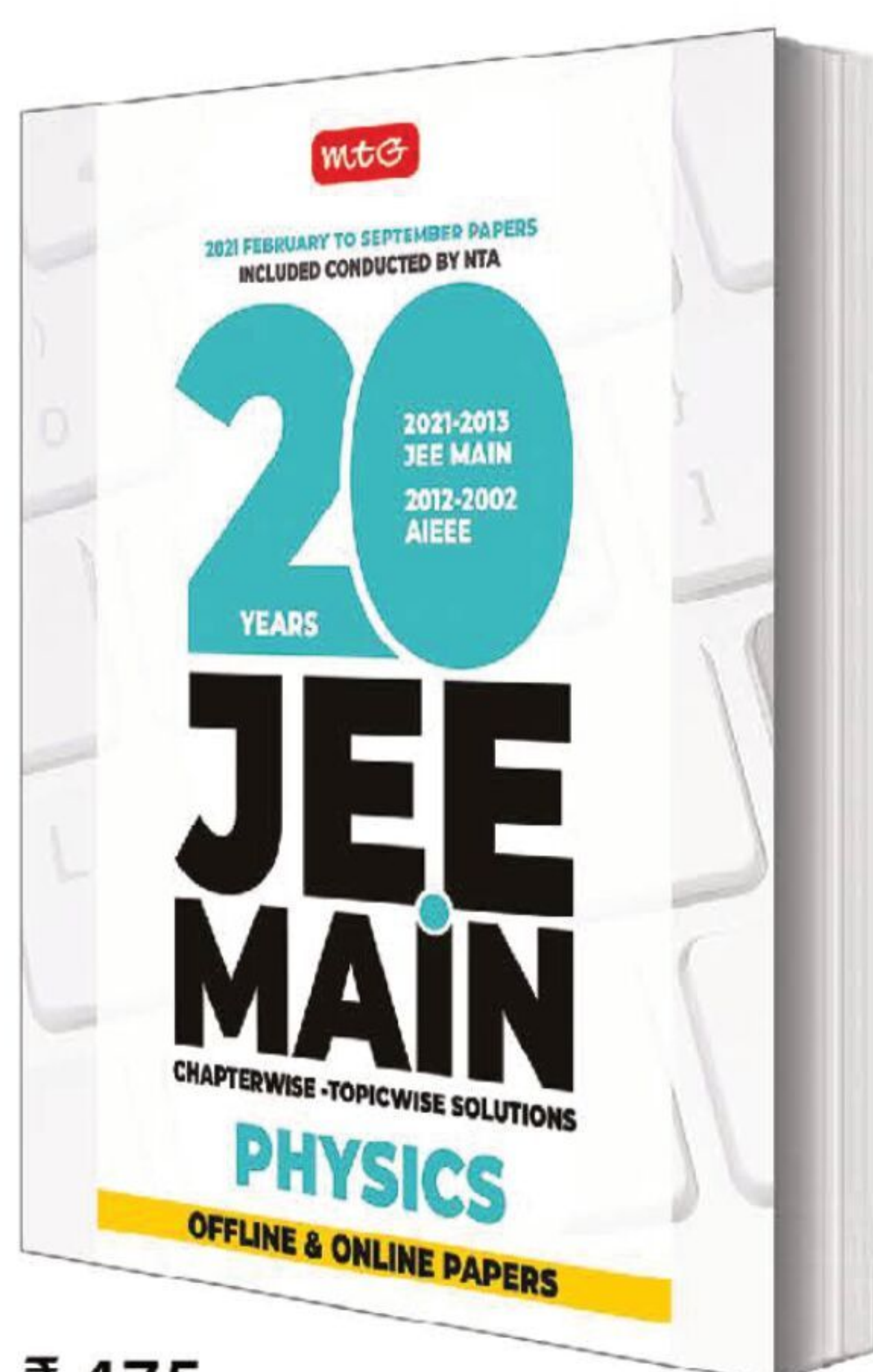
*Application to read QR codes required

Visit
www.mtg.in
for latest offers
and to buy
online!

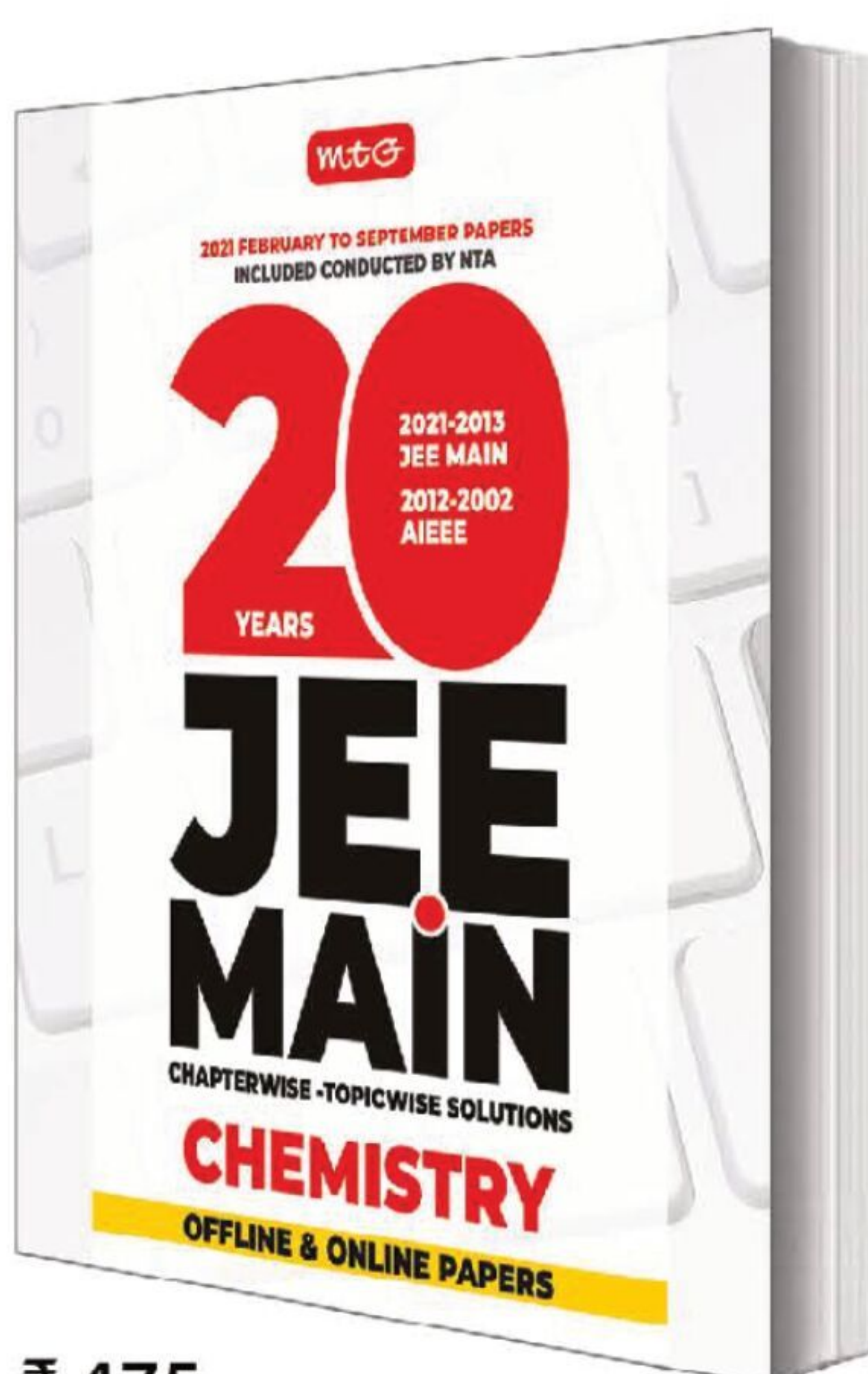


The Best tool for success in JEE Main

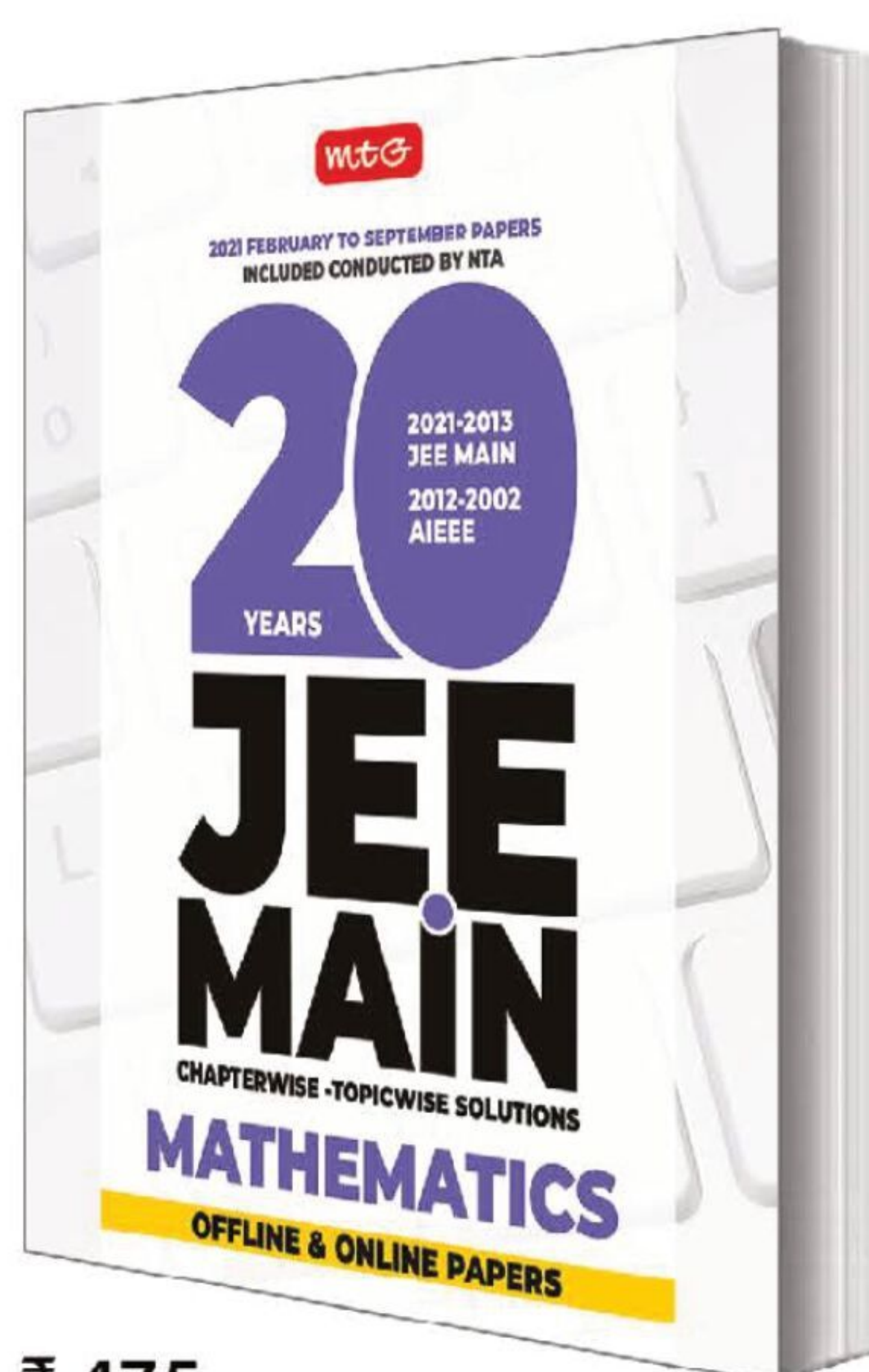
20 Years' JEE Main Chapterwise-Topicwise Solutions Physics, Chemistry and Mathematics contain not only chapterwise - topicwise questions that have appeared over the last 20 years in JEE Main / AIEEE but also their complete solutions. Needless to say these books are essential for any student to compete successfully in JEE Main.



₹ 475



₹ 475



₹ 475

HIGHLIGHTS:

- Chapterwise-Topicwise Questions (Online & Offline) of last 20 years' (2021-2002) of JEE Main / AIEEE
- Chapterwise-Topicwise segregation of questions to help you assess the level of effort required to succeed
- An unmatched series with more than 1552 pages filled with detailed solutions by experts

Visit
www.mtg.in
for latest offers
and to buy
online!

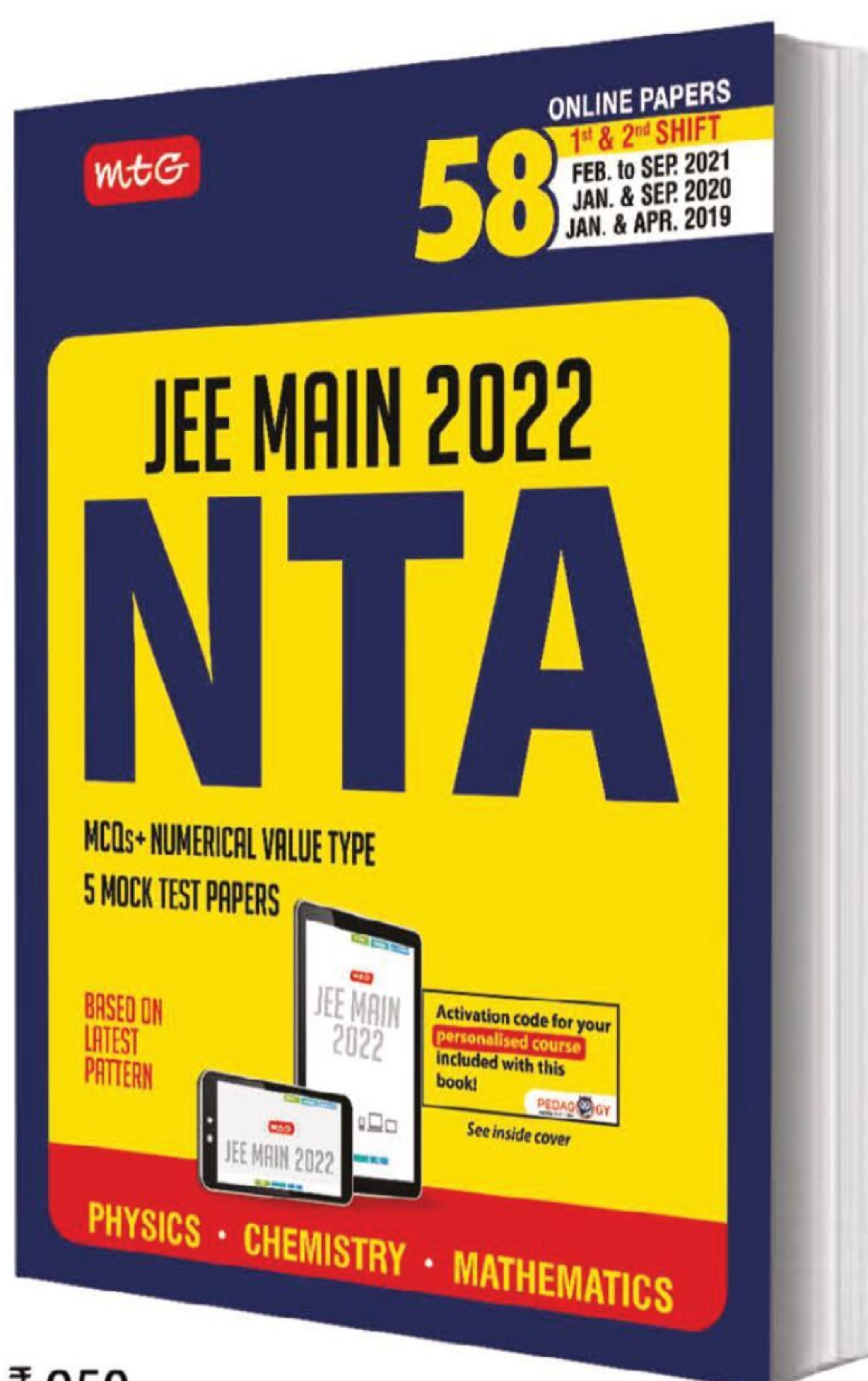


MTG Learning Media (P) Ltd.
Plot #99, Sector 44, Gurugram – 122 003 (HR)

Available at all leading book shops throughout India.
For more information or for help in placing your order,
Call 0124-6601200 or e-mail: info@mtg.in



Reach the peak of readiness for JEE Main 2022



₹ 950

Highlights

- Fully Solved Authentic Papers
- 26 (Feb, March, July & Sept. 2021) + 16 (Jan. & Sept., 2020) + 16 (Jan. & Apr., 2019) Online Papers
- 4915 MCQs for Practice
- Chapterwise Tabular and Graphical Analysis Showing the Weightage of Chapters
- 5 MTPs as per the latest JEE Main pattern

Practice Online Tests to Predict Your Rank

The Wait is Over! MTG Presents you all the 26 Fully Solved Question Papers of JEE Main 2021 Session (I), (II), (III) and (IV); 16 Fully Solved Question Papers of JEE Main (I) January and JEE Main (II) September 2020 & 16 Fully Solved Question Papers of JEE Main (I) January and JEE Main (II) April, 2019 conducted by NTA with Chapterwise graphical analysis showing the weightage of chapters and Mock Test Papers as per latest pattern of JEE Main. Get the maximum benefit from the book through personalised course on **Pedagogy app**. The best preparation for tomorrow is doing your best today so, go and get your copy.

Make It Happen, CRACK JEE Main

Get the complete feel of Online exam
by attempting tests on computers

Take the Final Leap Towards **JEE Main** Success!

Available at all leading book shops throughout the country. To buy online visit www.mtg.in.
For more information or for help in placing your order, call 0124-6601200 or email: info@mtg.in

To be a NEET champion, you need help from a CHAMPION

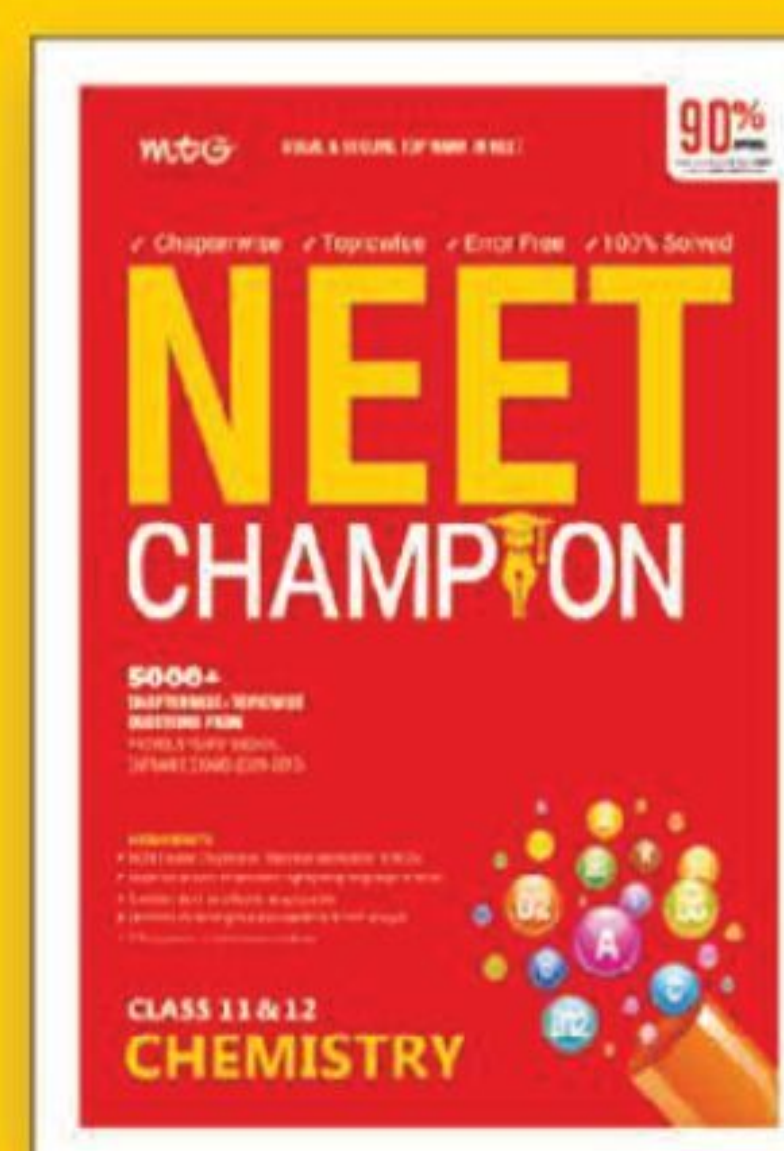


Skill. Passion. Hard work and determination. As a student sitting for the highly competitive NEET, you need all that. However, only a few will win, very likely with the help of a champion coach.

MTG's NEET Champion Series is just the coach you need. It will guide you in identifying what's important for success and what's not. And then help you check your readiness with its most comprehensive question bank.



₹800/-



₹800/-



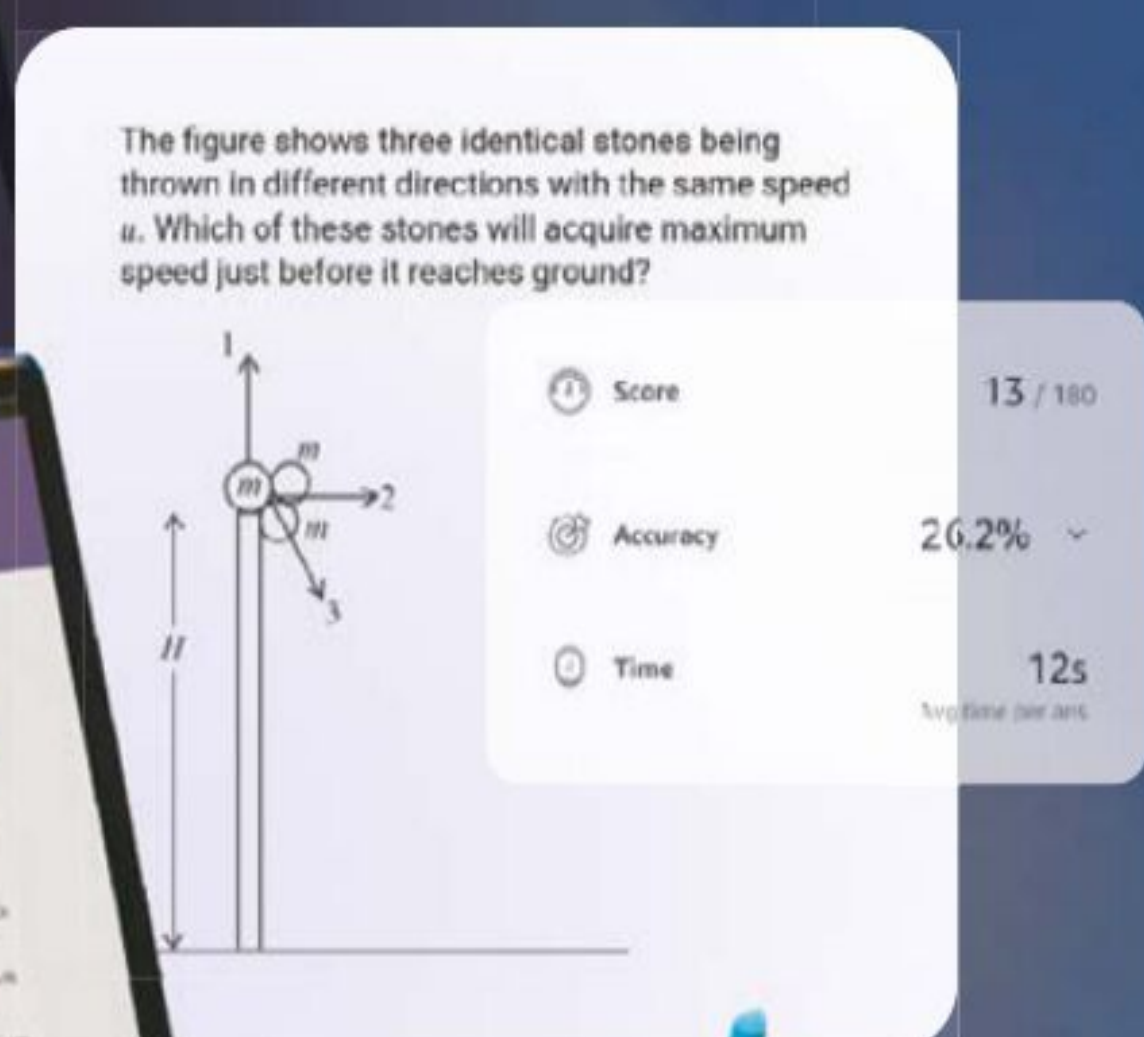
₹800/-

So you know your strengths and weaknesses right from the word go and course-correct accordingly. Put simply, MTG's NEET Champion Series will help you manage your preparation effort for NEET for maximum outcome. The best part is you study at a pace you're comfortable with. Because it's all chapterwise, topicwise.

HIGHLIGHTS

- NCERT-based • Chapterwise • Topicwise • 10 years' solved previous test papers (all major medical entrance exams) • Concise summary at the start of each chapter for quick revision of key concepts
- Analysis of importance of topics basis historical examination pattern • Test papers for self-assessment

Visit www.mtg.in to buy online.
Or visit a leading bookseller near you.
For more information, call **1800-10-38673** (toll-free) or **0124-6601200** today.
Email info@mtg.in



amazon academy

JEE & NEET Live Courses by Experts

Unleash the Winning Edge with Amazon Academy



Structured Courses with Experienced Faculty

Learn in live online classes with real-time doubt resolution



All India Mock Tests, Full, Part & Chapter Tests

Know your All India Rank and get detailed performance reports



17,000+ Practice Questions

Learn new problem solving techniques with in-depth solutions



Preparation Strategy Masterclasses

Analyse mock tests, devise preparation plans, stay motivated



FREE COUNSELLING SESSION*
+91 89290 37750



<https://academy.amazon.in/>

*Amazon Academy Free Counselling Terms and Conditions (available at: <https://amzn.to/3yAvWzQ>) apply to the counselling sessions offered by Amazon Academy.

JEE and NEET Study Packs



All India Mock Tests



Self-assessment tests



17K+ Practice Questions



Tip of the day

Study Packs
Starting ₹ 1499



NEET-UG 2021

Aakashians Create History!

Hat-trick of Perfect Scores (Classroom Program Students)





**All India
and
Telangana
Topper**

Mrinal Kutteri
2 YEAR CLASSROOM



**All India
and Delhi
Topper**

Tanmay Gupta
2 YEAR CLASSROOM



**All India
and
Maharashtra
Topper**

Karthika G Nair
2 YEAR CLASSROOM



**1
AIR
720/720**

HIGHEST CLASSROOM SELECTIONS IN INDIA*

63564* Aakashians Qualified in
NEET-UG 2021

49296 Classroom
14268 Distance & Digital

17*
State & UT
Toppers*

8*
Ranks in
Top 10 AIR

23*
Ranks in
Top 50 AIR

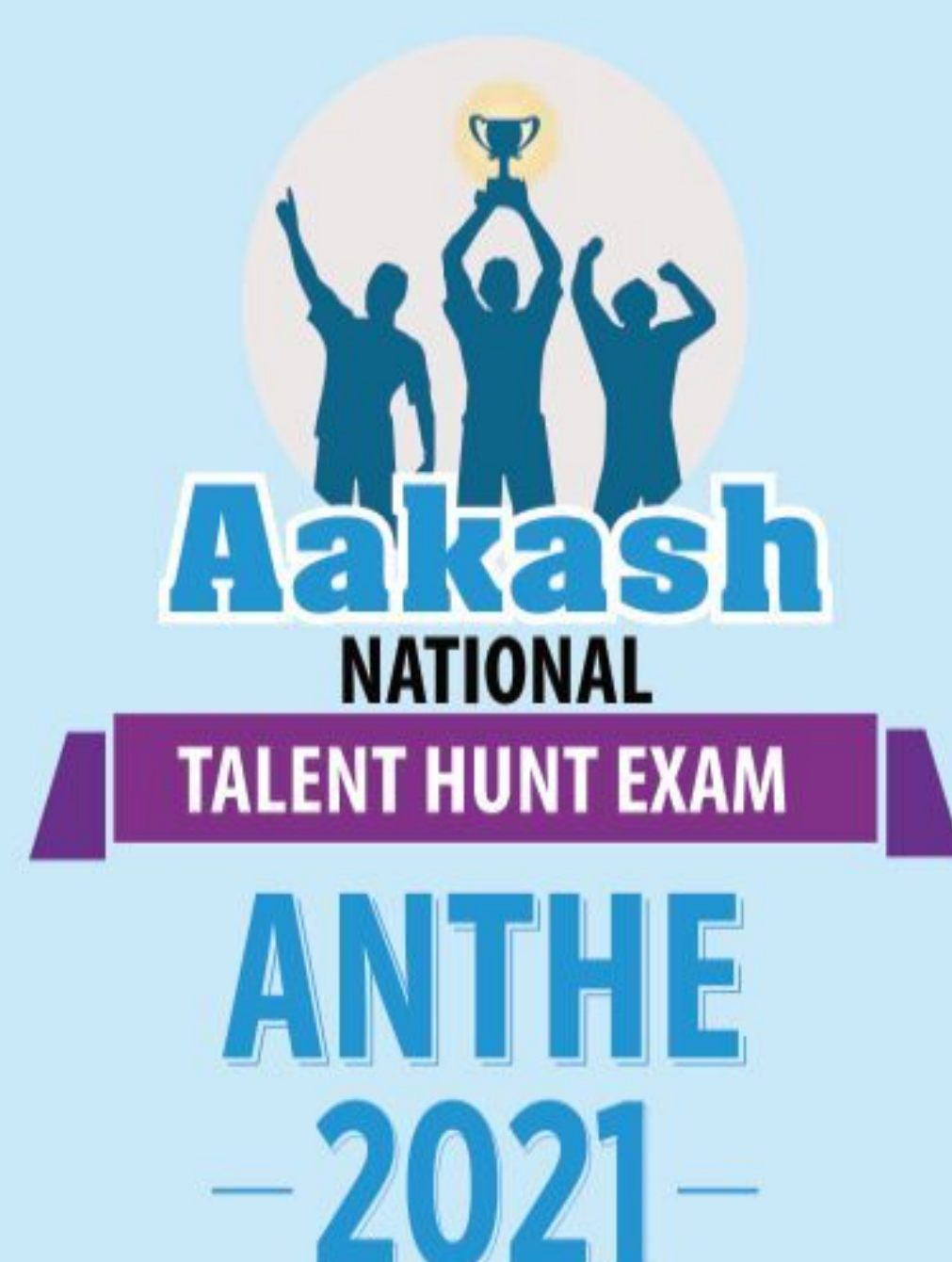
46*
Ranks in
Top 100 AIR

*Includes students from Classroom, Distance & Digital Courses across all categories | *Still Counting.

Highest Number of Top Scorers in NEET 2021 are from Aakash*

Marks Scored	Aakashians*
≥ 710	21
≥ 700	93
≥ 695	159
≥ 690	236
≥ 685	320
≥ 680	423
≥ 675	535

*Includes students from Classroom, Distance & Digital Courses across all categories



**For Class VII to XII
Studying Students**

AAKASH NATIONAL TALENT HUNT EXAM

**Get Up to
100%**

Scholarship*
(Top 100 Ranking students in each class
will also be eligible for Cash Awards)



**Win a trip to
NASA***

ONLINE EXAM DATES

11 to 19 DEC - 2021

OFFLINE EXAM DATES

12 & 19 DEC - 2021

To Register,

visit: anthe.aakash.ac.in

*Terms & conditions apply. 5 Students win an all expense paid trip to NASA.



SCAN TO REGISTER

ADMISSIONS OPEN

Repeater / XII Passed Batches

Get Up to 90% scholarship*

Classroom Coaching is open
as per respective state government guidelines.

*As compared with the available database in public domain of other similar educational institutes.

Though every care has been taken to publish the result correctly, yet Aakash Educational Services Ltd. shall not be responsible for error, if any.

Download **Aakash App**



CALL (TOLL-FREE)

1800-102-2727

VISIT

aakash.ac.in

